PB-230 091

POTENTIAL OIL POLLUTION INCIDENTS FROM OIL AND GAS WELL ACTIVITIES IN LAKE ERIE-THEIR PREVENTION AND CONTROL

International Lake Erie Water Pollution Board

September 1969

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THEIR PREVENTION AND CONTROL

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A REPORT OF THE INTERNATIONAL
LAKE ERIE WATER POLLUTION BOARD
TO THE
INTERNATIONAL JOINT COMMISSION

SEPTEMBER - 1969

CONTENTS

POTENTIAL OIL POLLUTION INCIDENTS FROM OIL AND GAS ACTIVITIES IN LAKE ERIE

- THEIR PREVENTION AND CONTROL -

LETTER OF TRANSMITTAL (iv)

MEMBERS OF THE ADVISORY BOARD (v)

MEMBERS OF AD HOC COMMITTEE (vii)

FOREWORD 1

INTRODUCTION 3

Past and Current Drilling Activity 3
Pollution Hazards from Offshore Drilling 7
Past Pollution Incidents in Lake Erie as a Result of Oil and Gas Well Development 9
Oil Pollution from Other Sources 11

SUMMARY AND CONCLUSIONS 15

REGULATION AND CONTROL 19

Drilling Regulations 19

- Ontario 19
- Pennsylvania 20
- New York 21
- Ohio 21
- Michigan 21

Adequacy of Regulations 22

TECHNICAL ASPECTS OF THE CONTAINMENT AND CLEAN-UP OF OIL SPILLS 23

Oil on Water: Containment 23

By Transfer of Cargo 23

By Mechanical Barriers 24

(a) Encirclement of the Source 27

(b) Protection of Harbours 28

(c) Protection of Shoreline 28

(d) "Trawling and Seining" 28

Oil on Water: Removal 30

Use of Mechanical Methods 30

(a) Skimming and Slurping 30

Use of Physical and Chemical Materials 33

(a) Adsorbing and Coagulating 33

(b) Sinking 35

(c) Dispersing 36

Oil on Shore 38

Protection of Shore Areas 38

The Inevitable Clean-Up 40

(a) Beaches 40

(b) Rocky Shorelines and Seawalls 41

(c) Harbours and Marinas 42

Disposal of Recovered Oil and Oil-Soaked Material 42

CONTINGENCY PLANS 46

General Description 46

Status 47

  United States 47

  Canada 48

Adequacy 49

  United States 49

  Canada 51

ACKNOWLEDGEMENTS 52

APPENDICES 53

DRILLING REGULATIONS

(i) Province of Ontario

(ii) Commonwealth of Pennsylvania

(iii) State of New York

(iv) Letter Stating Drilling Policy in State of Michigan. 161

BIBLIOGRAPHY 163

INTERNATIONAL LAKE ERIE WATER POLLUTION BOARD

September 2, 1969.

International Joint Commission,
United States and Canada.

Gentlemen:

In response to the request made by the Commission on April 1, 1969, the International Lake Erie Water Pollution Board has developed the attached report "Potential Oil Pollution Incidents from Oil and Gas Well Activities in Lake Erie - Their Prevention and Control."

In carrying out the Commission's directive, the Board has drawn upon the resources of federal, provincial and state agencies in both countries, and in addition has had discussions with representatives of the oil and gas industry currently operating on Lake Erie.

This report is organized so as to respond to the three questions put to the Board in the Commission's directive and represents a consensus of the Board on these questions. However, because of the State of Michigan's stated position on drilling in the Great Lakes,Mr. Ralph W. Purdy, a Board Member and Executive Secretary, of the Michigan Water Resources Commission has requested that this position (Appendix iv) be transmitted to the International Joint Commission along with this report.

Respectfully submitted,

Canada

E.A. Watkinson, M.D.
(Co-Chairman)

United States

H.W. Poston

H.W. Poston
(Co-Chairman)

INTERNATIONAL JOINT COMMISSION WATER POLLUTION BOARD

BOARD MEMBERS - INTERNATIONAL LAKE ERIE WATER POLLUTION BOARD

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Mr. John F. Hendrickson	International Affairs Officer, Federal Water Pollution Control Administration, Washington, D.C.
Mr. W.A. Lyon	Director, Bureau of Sanitary Engineering, Commonwealth of Pennsylvania, Department of Health, Harrisburg, Pennsylvania.
Mr. D.F. Metzler	Deputy Commissioner, New York State Department of Health, Albany, New York.
Mr. R. Purdy	Executive Secretary, Michigan Water Resources Commission, Lansing, Michigan.
* Mr. E.L. MacLeman	Regional Representative, Bureau of Water Hygiene, Department of Health, Education and Welfare, New York, New York.

* Appointment effective August 1, 1969.

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Dr. W.M. Cameron	Director, Marine Sciences Branch, Department of Energy, Mines and Resources, Ottawa, Ontario.
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Dr. W.M. Sprules	Director, International Fisheries Service, Department of Fisheries and Forestry, Ottawa, Ontario.
Mr. F.A. Voege	Assistant General Manager, Ontario Water Resources Commission, Toronto, Ontario.

INTERNATIONAL LAKE ERIE WATER POLLUTION BOARD AD HOC COMMITTEE ON POTENTIAL OIL POLLUTION INCIDENTS FROM OIL AND GAS WELL ACTIVITIES IN LAKE ERIE.

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I.J.C. Water Pollution Studies,
Public Health Engineering Division,
Department of National Health and Welfare,
Ottawa, Ontario.

Mr. J.F. Hendrickson,
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Federal Water Pollution Control Administration,
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Mr. W.A. Lyon,
Director,
Bureau of Sanitary Engineering,
Commonwealth of Pennsylvania,
Department of Health,
Harrisburg, Pennsylvania.

Mr. F.A. Voege,
Assistant General Manager,
Ontario Water Resources Commission,
Toronto, Ontario.

FOREWORD

This report is in response to a directive of the International Joint Commission dated April 1, 1969, to its International Lake Erie Water Pollution Board, requesting that the Board undertake the necessary investigations and studies to determine:

(1) *The adequacy of existing safety requirements and procedures in Canada and in the United States applicable to drilling and production operations in Lake Erie to prevent oil from escaping into the Lake so as to produce serious transboundary oil pollution conditions;*

(2) *The adequacy of existing mechanical, chemical and other methods of confining, removing, dispersing and cleaning up any major oil spill that may occur in Lake Erie from any source, bearing in mind the damage that such methods may cause to marine life, domestic water supplies or to other beneficial uses of the Lake in both countries;and*

(3) *The adequacy of existing contingency plans and the action taken to implement them to confine and clean up transboundary pollution and to prevent or mitigate the destructive transboundary effects of any major oil spills from any source that may occur in Lake Erie.*

Further, the Board was directed, if it found that any of the existing safety requirements, methods or plans referred to in clauses numbered (1), (2) and (3), respectively are inadequate, to make recommendations as to what action should be taken to correct any such inadequacy.

The current concern over oil and gas well drilling activities in Lake Erie, which resulted in a request by the Governments of the United States and Canada to the International Joint Commission, and the subsequent directive to the International Lake Erie Water Pollution Board, was prompted by the recent serious oil pollution incident off the coast of California. Oil began leaking on January 28, 1969, from a well being drilled on the submerged portion of the coastal plain off Santa Barbara. The flow of oil continued for 11 days, at an estimated flow of 500 barrels per day. Shore facilities sustained the greatest damage, with minor damage to water birds, local fisheries and other aquatic life.

Earlier reports on the hazards of water pollution resulting from oil and gas well drilling operations in Lake Erie concluded that there was minimal risk from this source and that "with existing technology, any accidental escape would be limited to a matter of minutes". The experience at

Santa Barbara has caused concern that the conclusions of earlier reports may have been overly optimistic.

For the preparation of this report the findings of earlier documents have been reviewed. The report also compares the pollution potential from oil and gas well drilling in Lake Erie with similar activities on the continental shelf off California and with other sources of oil pollution in the Lake Erie Basin.

INTRODUCTION

Past and Current Drilling Activity (1), (2)

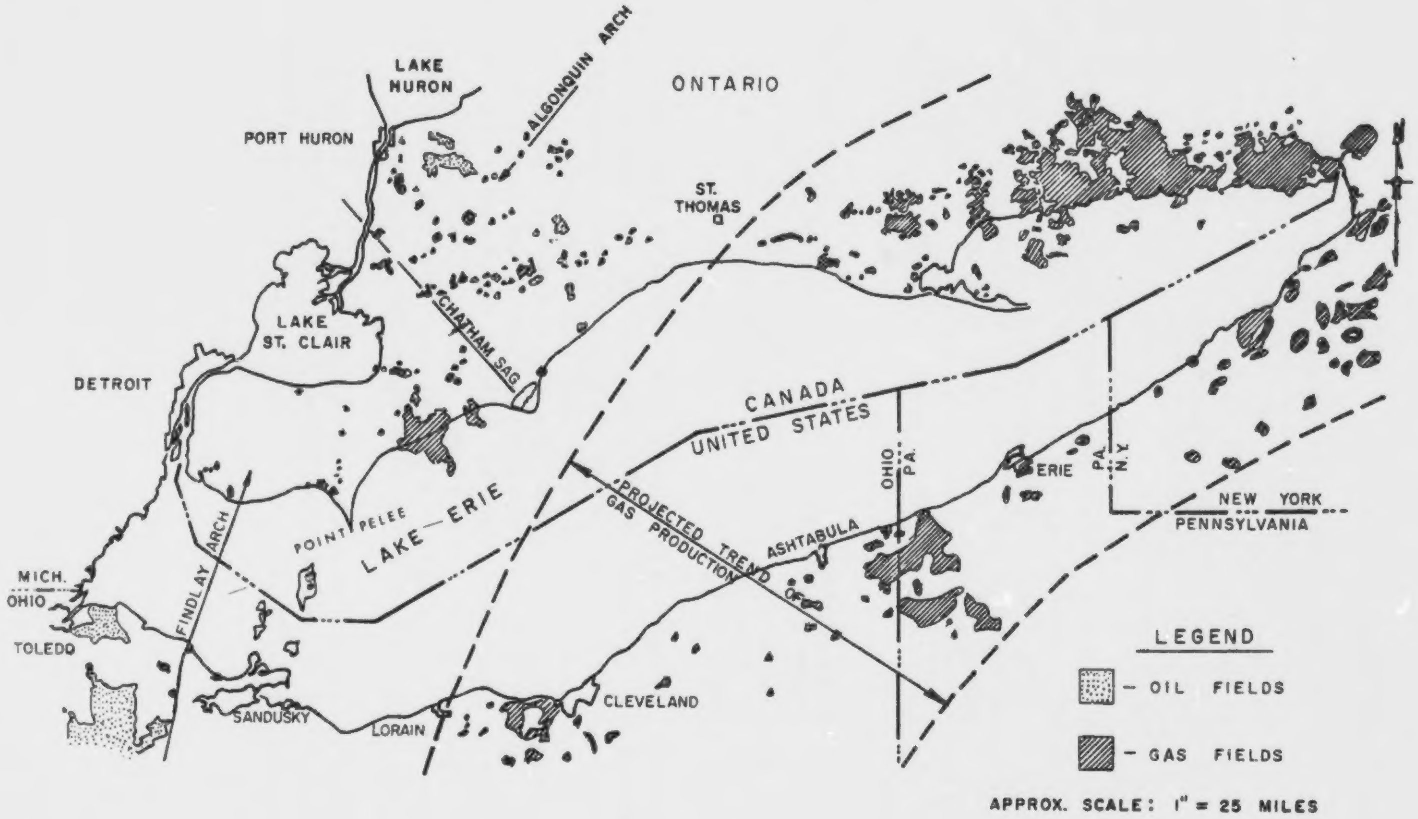
The first off-shore well drilled in North America was completed on May 15, 1913 in the Canadian waters of Lake Erie opposite the Township of Romney. Further gas wells were completed during the following three years. However, not until 1943 did exploration and development of the gas resources begin in earnest. Since that time interest in off-shore operations has been high.

Natural gas is now being produced in substantial quantities from Canadian submerged lands in Lake Erie. At the end of 1968 over 250 wells of approximately 600 drilled were producing or are capable of producing natural gas at the rate of about 3,700 million cubic feet per year, or 30% of the province of Ontario's total production. During 1968 forty-five new wells were drilled in Lake Erie of which 16 were producers.

Few wells have been drilled in the U.S. portion of Lake Erie and from these there has been no production of either oil or gas to date. Some leasing occurred in Pennsylvania waters in 1957 and 1968, but no drilling is anticipated before 1970. (Fig. 1)

Production of gas off-shore and oil and gas on-shore in the Lake Erie region is obtained from sediments of the Palaeozoic age. (Fig. 2) These dip south and southeast from the Canadian Precambrian Shield and the Algonquin-Findlay arch beneath the lake into the Appalachian Basin. Gas reserves are located in Clinton-Cataract sandstones of middle and lower Silurian age and in Guelph bioherm reefs of the Middle Silurian age. These formations produce significant amounts of gas on and off-shore in Ontario. Producing depths in Lake Erie range from depths of 500 feet to 2500 feet.

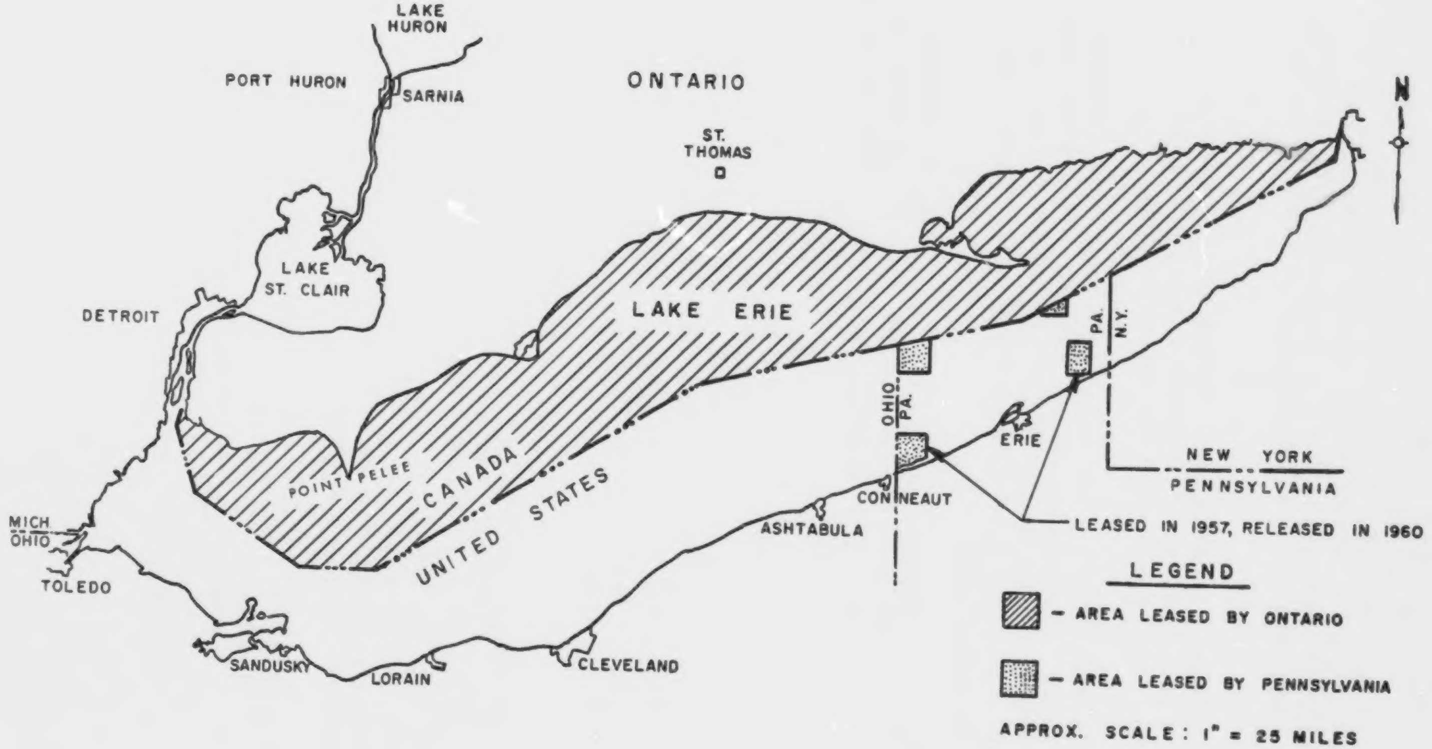
Across the lake on-shore in eastern Ohio, Pennsylvania, and western New York, these same Silurian reservoirs are also gas productive off the east flank of the Cincinnati-Findlay-Algonquin arch.


LAKE HURON
PORT HURON
ALGONQUIN ARCH
ONTARIO
ST. THOMAS
LAKE ST. CLAIR
CHATHAM SAG
DETROIT
CANADA
UNITED STATES
OHIO
PA.
PA.
N.Y.
ERIE
NEW YORK
PENNSYLVANIA
POINT PELEE
LAKE — ERIE
MICH.
OHIO
FINDLAY ARCH
PROJECTED TREND OF GAS PRODUCTION
ASHTABULA
TOLEDO
SANDUSKY
LORAIN
CLEVELAND
LEGEND
▨ - OIL FIELDS
▨ - GAS FIELDS
APPROX. SCALE: 1" = 25 MILES

OIL AND GAS FIELDS IN AND NEAR LAKE ERIE

JULY 1968

FIGURE 2


LAKE HURON
PORT HURON
SARNIA
ONTARIO
ST. THOMAS
N
LAKE ST. CLAIR
DETROIT
LAKE ERIE
MICH.
OHIO
TOLEDO
POINT PELEE
CANADA
UNITED STATES
OHIO
PA.
PA.
N.Y.
ERIE
NEW YORK
PENNSYLVANIA
CONNEAUT
ASHTABULA
LEASED IN 1957, RELEASED IN 1960
SANDUSKY
LORAIN
CLEVELAND
LEGEND
▨ – AREA LEASED BY ONTARIO
▒ – AREA LEASED BY PENNSYLVANIA
APPROX. SCALE : 1" = 25 MILES

LEASED ACREAGE OF LAKE ERIE

FOR OIL AND GAS DRILLING

JULY 1968

FIGURE 1

The geology strongly suggests an extension northward into Lake Erie of these productive trends to connect up with the production developed in the Canadian portion of Lake Erie. The finding of commercial quantities of gas underlying U.S. waters seems virtually assured, if leasing and drilling are carried out on the United States side of the Lake.

Other possible productive trend extensions are the Middle Ordovician Trenton formations which are productive along the Cincinnati-Findlay arch in western Ohio.

Production may also be obtained from the Cambrian and Lower Ordovician formations which are for the most part untested. Many shows of hydrocarbons have been found in previous drilling and several major fields are producing both north and south of Lake Erie.

Recoverable reserves of gas from Lower Silurian reservoirs underlying Pennsylvania waters are estimated at two billion cubic feet for 640 acres, or about three million cubic feet per acre.

In 1967, production in Canadian waters amounted to 4.14 billion cubic feet of gas. Rentals, royalties and taxes received by the Province of Ontario for this production were about $675,000, compared to $236,000 in 1966. Reasonable leasing arrangements, high success ratios, modern fracturing techniques, excellent market price with no proration make the economics for exploration and development attractive.

There is no commercial oil production in Lake Erie at the present time, although one well drilled in 1967 did encounter a significant oil show. The commercial aspects of this oil have not as yet been determined. The industry has also indicated that even if it should find oil in commercial quantities that it is not prepared at the present time to develop this energy resource.

It is probable that the portion of Lake Erie west of Pelee Point is underlain with reservoirs which contain both oil and gas. The chances of finding oil in that portion of Lake Erie, east of Pelee Point are considerably less. It should be noted, however, that although the chances of finding oil in commercial quantities in the Clinton-cataract sandstones in Lake Erie are remote, there is significant oil production in these sands on-shore in East Central Ohio. In addition, oil shows on the Canadian side are not uncommon and some oil has been produced near the city of Brantford, Ontario, in years past.

Deeper objectives which yield oil on land around the western end of Lake Erie in both the U.S. and Canada are present under most if not all of Lake Erie, but only the Cambrian, at a depth in excess of 4000 feet or greater, would seem to have potential for commercial oil accumulation. Oil production in Lake Erie in the eastern basin is possible but not nearly as probable as gas production.

In summary, virtually all of the reserves discovered to date in Lake Erie, in quantities economically exploitable have been gas. In addition, the volume of oil and gas and the rock pressures encountered are of a lesser order of magnitude than those that have been encountered on the California continental shelf or the Gulf of Mexico, therefore the possibility of oil pollution resulting from a blow-out is thus correspondingly less in Lake Erie.

Pollution Hazards from Offshore Drilling

Underwater drilling in Lake Erie or on any body of water poses problems uncommon to similar land activities. The drilling regulations and drilling practices in Lake Erie, to-day, bear witness to earlier experiences in the Gulf of Mexico where water pollution problems were reported to have been the result of the improper practices of careless operators during the early development of the offshore oil resources. Seismic operations using underwater explosions killed fish life and caused silting of spawning grounds. Channel dredging to create bargeways for access to drilling areas resulted in the deposition of spoils on nursery grounds and shellfish beds. Changes in flow patterns caused damage to fresh water areas when ocean drilling was involved. The disposal of spent drilling muds containing caustic, oil, taste and odor producing material, toxic material, and finely divided clay particles had a serious effect on aquatic life forms. Waste oil slop was a continuous source of oil slicks around drilling barges. These oil slicks affected water fowl, boating and fishing. All of these pollution effects can be prevented with proper planning and operation.

Today in offshore exploration and production, new techniques and equipment are being employed to avoid harm to aquatic life and to prevent pollution of the waters. Over 80% of the total seismic exploration for hydrocarbons off the continental United States is accomplished by using an energy source other than dynamite. Explosives in any form are not permitted to be used in the waters of Lake Erie for oil and gas explorations.

Hypothetically, the production of oil from offshore wells involves the risk of some loss of oil. The wastage of chemicals and crude oil during formation treating operations can also be a source of pollutants. Oil-water separation devices can discharge brines containing significant amounts of oil. Oil gathering lines, barges and tanks involve the constant threat of breakage and leakage and resulting discharges of oil.

The spillage, leakage, and deliberate discharge of these pollutional materials can have significant effects on recreational areas, aquatic life, waterfowl, water supply, and pleasure boating. Lake Erie is used extensively for recreational purposes as well as being a major source of public and industrial water supply. The effects of pollution by oil on these water uses could have serious economic impact.

The development of offshore gas resources involves pollution hazards of much less magnitude than the development of oil resources, however drill cuttings and drilling muds may be discharged during well development and this could affect the turbidity of the Lake's water and bottom living organisms. The presence of minor quantities of oil incidental to the production of gas may present an additional hazard , but these can be safely retained on board.

The presence of men on drill rigs and service vessels leads to the possibility of sewage pollution and the dumping of trash, garbage, and refuse into offshore waters. This pollution threat is no more, no less than that posed by commercial vessels and pleasure craft. In addition, the industry has indicated that all drill rigs operating in Canadian waters will be equipped with aerobic sewage treatment units by the end of 1969.

Past Pollution Incidents in Lake Erie as a result of Oil and Gas Well Development.

In Ontario, experience with oil wells in the Great Lakes has been limited in extent and of short duration. A report of the Special Committee on Oil and Gas Resources completed for the Government of Ontario, in 1961 reported that: "One well which was characterized as an '*indicated oil producer*' was completed in 1958 by Putnam and Putnam northeast of Pelee Island. It has been closed in since then. In 1959, Place Gas and Oil Company obtained oil from their No. 1 well off Colchester. This has been referred to as the first oil well of '*commercial rating*' in Lake Erie".

The Committee further reported on the only two oil pollution incidents documented in Lake Erie from oil and gas well development. These were considered to be of minor significance.

> *It was the Place No. 1 well which excited so much comment when it flowed for several minutes out of control on August 3, 1959. The only estimate of the amount of oil which was discharged into the lake that the Committee could find was 5 barrels. This is consistent with the behaviour of oil wells in Western Ontario in that the 22 new wells completed in 1958 had an average reported flow of 43 barrels per day (maximum 150 barrels per day) and the 19 new wells completed in 1959 had an average reported flow of 58 barrels per day (maximum 250 barrels).* (1)

The Committee also noted a similar spill occurred from Place's No. 4 well on September 7, 1960. Apparently this spill deposited a film of oil along the shore, which the Committee concluded was inevitable since shore winds were present. They stated, however, that such films are dissipated by evaporation, absorption or shore currents in a matter of hours.

The study by the Special Committee concluded that the development of Ontario offshore oil and gas fields was desirable and could be done without causing water pollution or other undesirable effects. Offshore drilling and the production of both oil and gas have been permitted to continue in Lake Erie with no adverse effects on water quality since the Committee submitted its report in 1961. In fact, Canadian drilling has been carried out since 1913 without significant pollution incident.

In addition to Ontario's experience, two offshore wells have been drilled in the Pennsylvania waters of Lake Erie. These wells were drilled under leases issued by the Pennsylvania Department of Forests and Waters and permits for waste discharge to the Lake from the Pennsylvania Sanitary Water Board. Water quality criteria were established for the well drilling operations. These criteria specified that oils, brines and other materials must be so treated that not more than 15 mg/l of oil and not more than 15 mg/l of suspended solids would be discharged to the Lake. The criteria also specified that water quality within 100 yards of the drilling operation must be such that salinity, hardness, turbidity and other characteristics of the receiving waters would not be increased beyond the maximum values set forth in the U.S. Public Health Service Drinking Water Standards.

The Pennsylvania Department of Health conducted surveys in 1959 in the vicinity of the drilling platforms used by the New York State Natural Gas Corporation during the drilling of these two wells. The surveys were conducted while the drill rigs were in operation and while drill cuttings were being deposited on the Lake floor. The permittee was also required to conduct similar surveys and employed the services of a consulting sanitary engineer to perform this work. These surveys indicate that there was no analytically detectable effects on water quality within 50 yards of the drills rigs. Samples were collected and analyzed for color, odor, turbidity, pH, alkalinity, chlorides, total solids, iron and oil. There was no measurable increase in the concentration of any of these water quality parameters.

Investigations conducted by the Department of Health during these drilling operations confirmed those of the consulting engineers and indicated that the water quality criteria were not violated.

Though drilling to date has been conducted in Lake Erie without serious pollution incident, accidents should be anticipated if extensive drilling is continued. To minimize this possibility, regulations must be strongly enforced and drilling closely supervised. Additionally, it is essential that co-ordinated plans for responding to pollution incidents from any source be developed.

Oil Pollution from Other Sources

This report would be incomplete if it did not attempt to identify other potential sources of oil pollution in Lake Erie, their magnitude relative to that from oil and gas well drilling, and their relative chance of occurrence.

The sources of any potential threat of pollution by oil are as varied as the uses to which oil and petroleum products are put, and the means of transportation by which these products are moved from producer to consumer. These involve almost all manufacturing and production processes, product transfer operations, storage areas, loading facilities, freighters, pipe lines, tank cars, and trucks.

Shipping

The steady growth of world and domestic commerce has resulted in considerable expansion in world shipping. With the opening of the St. Lawrence Seaway in 1959, traffic in the Great Lakes has increased steadily. In the Welland and St. Lawrence canals alone, tonnages have more than doubled.

Though shipping is extensive on the Great Lakes, the chance of a disaster of the magnitude of the Torrey Canyon (a spill of crude oil in the amount of 119,000 tons) is highly improbable at this time because there is no large scale vessel transport of oil on the Great Lakes. The extensive refinery operations along the Lakes' shores are supplied with crude oil primarily by pipeline. In addition, the major portion of their products also travels overland by pipeline or tank transport. The one largest continuing threat of oil pollution on the Great Lakes is from ship's fuel bunkers. The waterborne commercial fleets are powered almost exclusively by oil. (A report (3) by the Secretary of the Interior and Secretary of Transportation to President Johnson, in 1968, indicated that the average fuel capacity of foreign vessels to be 1500[1] tons, and for U.S. vessels, 2500 tons). It is likely, then, that commercial ships plying the Great Lakes carry in excess of 1000 tons of bunker oil as fuel. A collision or grounding of a Great Lakes carrier, with subsequent rupturing of fuel bunkers, could release to the Great Lakes a quantity of oil greater than that released during the whole of the period that the uncontrolled well off Santa Barbara was discharging (500

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1 - 1 Barrel of oil equals 42 gallons (U.S.)
1 ton of oil is approximately equal to 6 barrels.

barrels/day for 11 days; a quantity of crude oil much less than 1000 tons). A spill of oil resulting from a ruptured ship's fuel tank would be enough to pollute extensive areas of the lake and many miles of shoreline.

Other continuing discharges of oil from ships result from the practice of deballasting of vessels, the cleaning of oil tanks, and the pumping of bilge water which collects in the below-decks areas of vessels and which usually become mixed there with waste oils. It has been estimated (3) that the average merchant vessel would use as much as 40 per cent of its fuel capacity for ballast and would discharge a mixture containing one per cent of oil when deballasting.

The potential release of fuel from the bunkers of some 30 sunken ships in the two lower lakes also poses a threat of oil pollution. The inspection of these sunken hulksto determine their pollution potential should be considered.

In addition to the potential, and continuing pollution by oil from waterborne traffic, there are major shore sources. The U.S. Corps of Engineers has estimated that 40 per cent of all oil pollution enforcement cases with which it is involved are from non-vessel discharges.

Product Transfer, Shore Storage and Pipelines

Products arriving at or departing from waterside facilities may be handled several times. Both crude and refined oil products may travel via pipeline, railroad or tank truck as well as by marine vessel producing almost endless possibilities for accidental spills. In addition other hazardous substances are transported in a similar manner and may well pose serious disaster potential. Ruptured tanks, levee and dike failures, pipeline breaks, and human errors are leading causes of spills. Retention levees around storage tanks and material handling requirements are generally designed for safety and fire prevention. They are not designed for pollution prevention and often do not function to prevent pollution.

One of the classical pollution incidents on the Great Lakes occurred at Parry Sound, Ontario, in 1950 when 40,000 barrels of oil were spilled into the Sound off Georgian Bay, as a result of a tank failure. The company responsible for this spill was obliged to clean the beaches, even to the extent of renewing the sand.

The pipeline transportation system that interlaces our continent poses a serious risk of oil pollution in the Great Lakes Basin. Spills occur through accidental punctures, cracked welds, and leaks caused by corrosion.

In addition, if oil were produced commercially in Lake Erie, pipelines from offshore platforms to storage facilities may be subject to rupture by storms, ice movements, and the dragging of ships anchors.

Municipal and Industrial Sources

Even properly operated municipal and industrial waste treatment facilities, unless designed and operated specifically to remove oil, normally can cope with very limited quantities of oil. This limit is easily exceeded. Even a moderate amount may upset the operation of a plant and be discharged directly to the receiving stream. In addition to the waste oil that gets through sewage treatment plants, waste oil also finds its way directly into streams and lakes through storm sewers and combined storm and sanitary sewer systems.

In recent months, a major industrial spill in the Trenton Channel, of the Detroit River, allowed an estimated 96,000 gallons of cutting oil to enter the Western Basin of Lake Erie. Fortunately, the resulting slick was blown offshore where it subsequently weathered and dispersed.

In addition to the waste oils discharged daily by municipalities and industries to Lake Erie and its tributaries (in 1951, it is estimated that the imput of oil and grease to the Detroit and St. Clair Rivers is in excess of 175 tons per day or the equivalent of more than 1000 barrels per day), oils are released in the disposal of dredging spoils. Studies of dredging operations in Cleveland Harbour, during 1966-67, revealed that 660,000 tons of dry solids were disposed of in the lake. This included 17,600 tons of oil and grease.

Disposal of Spent Oils

Other sources of oil pollution in the Great Lakes results from the disposal of spent oils. The report on Oil Pollution prepared in 1968 for President Johnson considered the problem as it affects the United States as a whole. Many of the statements made apply equally well to the Great Lakes and satisfactorily categorize Canadian conditions as well.

"Unlike cargo spills, waste oil has served its purpose and therefore presents a different kind of pollution problem. It is a troublesome residue that must be disposed of in very large quantities day in and day out. The sources of waste oil are varied but can be categorized as follows:

Some 350,000,000 gallons of used motor oil must be disposed of annually by the more than 210,000 gasoline filling stations in this country (in the United States). These stations have long been key suppliers of used oils to oil refiners. Re-refined oils are used in railroad journals, to freeze-proof coal, as dust control for rural roads, and as motor oils and industrial lubricants. Re-refining, however, has now become a marginal business. In the last 5 years more than half of the re-refiners have gone out of business due to changes in labeling requirements and in the tax laws. As the demand for used oil for re-refining diminishes, more of this material must be disposed of in other ways. Waste oil, uncollected and unused, too often winds up being flushed into city sewers because this is the easiest way for many - filling station operations and others - to dispose of small amounts of oil". (3)

SUMMARY AND CONCLUSIONS

The potential for incidents of oil pollution in Lake Erie, includes, but can by no means be limited to oil and gas well exploration and development. Other potential sources which pose possibly greater threats are the significant tonnages of oil in ship's fuel bunkers, industrial spills, and the continuing discharge of oils in municipal and industrial effluents.

Oil and gas well explorations have been conducted in the Canadian waters of Lake Erie since 1913, without serious pollution incident. It is recognized, however, that if drilling is extensive, accidents may result. To minimize pollution from this source and its effects, comprehensive oil and gas well drilling regulations providing lake-wide compatibility and including effective pollution control provisions and surveillance, are required. In addition, emergency standby arrangements are required to protect Lake Erie's valuable water resource from the effect of spills of oil, or other hazardous materials.

In response to the three questions asked of the Board by the Commission, the Board submits the following:

> *(1) The adequacy of existing safety requirements and procedures in Canada and in the United States applicable to drilling and production operations in Lake Erie to prevent oil from escaping into the Lake so as to produce serious transboundary oil pollution conditions;*

The Board finds that generally there are adequate regulations concerning drilling and production operations in Lake Erie, but there are provisions in the regulations which could be strengthened. Such activities fall under the respective provincial and state jurisdictions and are administered by agencies of these governments. There is an overwhelming consensus however, that any regulation is only as effective as its enforcement. The best evidence of effective implementation of existing regulations is the successful record of trouble-free drilling in Lake Erie up until the present time. It is further recognized that even well regulated drilling may be accompanied by accidents. It is therefore very necessary that the means be available to accommodate such a contingency.

The Board recommends that:

All offshore drilling operators be required to strictly adhere to present regulations and lease agreements for the prevention of pollution.

Responsible water pollution control authorities insure that adequate aquatic biota information be collected in drilling areas, both before and after drilling activities.

A high degree of interagency co-operation be encouraged in surveillance of offshore drilling sites which will include frequent inspections.

Compatibility of lake-wide drilling regulations be maintained.

> (2) *The adequacy of existing mechanical, chemical and other methods of confining, removing, dispersing and cleaning up any major oil spills that may occur in Lake Erie from any source, bearing in mind the damage that such methods may cause to marine life, domestic water supplies or to other beneficial uses of the Lake in both countries.*

A review of existing means of combatting spills of oil indicates that there is no one method, either mechanical or chemical, which can be considered a panacea. Different situations may well require different responses.

Experience has shown that where contingency plans have existed and have been implemented at the time of a spill, though notification and response have been reasonably good, the mitigation of *all* damages has not been achieved because of the very great difficulties in confining, removing and disposing of *all* of the oil. It should further be noted that in the event of a large spill of oil in the open waters of Lake Erie, that adequate methods of confining the oil with subsequent removal are only available under the most ideal weather conditions.

Research is urgently required on methods of containment of oily materials, and their subsequent removal. It is evident that at the time of a spill those responsible for containment and clean-up must have at their disposal the best technical advice available. This suggests the need, in contingency planning, for advisory teams which can immediately report to the site of a spill to provide the necessary technical support.

(3) *The adequacy of existing contingency plans and the action taken to implement them to confine and clean up transboundary pollution and to prevent or mitigate the destructive transboundary effects of any major oil spill from any source that may occur in Lake Erie.*

Regional contingency plans for the Great Lakes region have been developed and provide a response capability for spills which might occur in U.S. waters. An assessment of the adequacy of existing U. S. plans is difficult in the absence of a satisfactory record of experience. They appear to be generally complete and detailed although the role of State and local and private agencies and organizations is not clear. Contingency planning should include a local response capability wherever an oil pollution potential exists.

A national contingency plan for Canada is only now being developed under the aegis of the Federal Government's Interim Inter-Departmental Committee on Water. Individual agencies, such as the Ontario Water Resources Commission, the Ontario Department of Energy and Resources Management and the Federal Department of Transport have internal response mechanisms established. However, these individual plans have been virtually unco-ordinated.

A major oil spill in the Canadian Waters of Lake Erie, at the present time, would necessarily be met with only a fraction of the response capability available in that country, because of the lack of co-ordination between federal, provincial and local authorities.

The Water Pollution Board probably represents the best vehicle for interim co-ordination. Considerable urgency should be attached to the development of co-ordinated contingency plans in Canada. It will then be necessary for the Water Pollution Boards to interrelate the existing United States multiagency contingency plan for pollution spills in the Great Lakes region with whatever regional plan is developed on the Canadian side and to ensure their compatibility, in order that spills having international implications can be readily accommodated.

In addition a mechanism is needed whereby the government of either country with the concurrence of the International Joint Commission may call on and receive the assistance of the government of the other country when spills of pollution occur in any international waters prescribed as such under the Boundary Waters Treaty, when such spill has or is likely to have an adverse effect on the quality of such Boundary Waters; or will cause, or is likely to cause damage to persons and/or property on the other side of the boundary.

The Board also recognizes that the potential disaster associated with oil and gas well drilling activities in Lake Erie is only one of many, and indeed may be one of lesser significance than other potential occurrences. This report has documented other major sources of oil pollution. Oil pollution, however noisome, cannot even be compared to the catastrophic effects which could occur through the release of a large quantity of insecticide or pesticide or other toxic material into the Great Lakes system. The disastrous results of even a relatively small quantity, released into the Rhine River recently, substantiates this concern. The means are not presently available to adequately cope with this type of catastrophy should it occur on Lake Erie.

Commercial carriers, to-day, ply the Lakes carrying cargoes of all nature of things. It is estimated that every ship transporting mixed cargo carries some quantities of hazardous materials. Bulk carriers may well be transporting dangerous substances. At the present time no detailed records are kept concerning the exact nature and quantity of hazardous cargo. Programs should be implemented immediately in order that this information can be made available to water quality management agencies so that disaster prevention can be implemented, and accident response mechanisms broadened so as to accommodate any contingency.

This report attempts, in subsequent sections, to deal with the suitability of existing drilling regulations, the science of containment and clean-up, and the adequacy of current contingency planning.

REGULATION AND CONTROL

Drilling Regulations

Ontario

Offshore drilling has taken place for many years in the Province of Ontario. Interest has been high in offshore exploration since 1943 when the possibility of discovering large quantities of natural gas became apparent. Current regulations under The Energy Act, 1964, O. Reg. 420/68 were most recently amended in December 1968. The amendments made bonding requirements in Ontario and Pennsylvania compatible.

Waste disposal requirements are not as specifically defined in the Ontario regulations as they are in the Pennsylvania lease agreements, however their application is the same. The Ontario regulations specify that fluids produced during drilling and water produced during production must be disposed of in a manner that will not interfere with the rights of any person. Salt water drilling fluids, oil, refuse and flammable products must be handled so not to create a health or safety hazard or contaminate fresh waters.

In addition to the waste disposal requirements made necessary under the Energy Act of 1964 and mentioned above, the requirements of the Ontario Water Resources Commission Act must be satisfied in all cases for the preservation of water quality from any wastes that may arise from oil and gas well drilling and production.

Offshore well operators are required to carry $1,000,000 in liability insurance coverage to compensate for all damages caused by drilling and production operations. Plans and specifications for the wellhead assembly,drilling,and casing programs must be submitted to the Department of Energy and Resources Management for approval before a drilling permit is issued. Production casing must be cemented to the surface before production begins and the wellhead must be encased below the bed of the lake or must not exceed 5 feet above the bed of the Lake. Trawl deflectors must be provided in trawling areas and other protective devices may be required where other types of commercial fishing are likely. Wellheads must be marked and identified by company name and when wells are plugged, casings left in the well must be cut at or below the bed of the Lake.

The Ontario authorities license all drilling equipment and consider the competence of the drilling company's personnel before issuing approval for drilling. In addition, the Ontario Department of Lands and Forests and the Canadian Department of Transport are advised of all drilling permits issued for Lake Erie.

Pennsylvania

Pennsylvania's requirements for offshore drilling are contained in the lease agreements issued for each offshore lease. In addition, a permit is required from the State Mining Department. The provisions of the lease agreements were developed in close co-operation with other jurisdictions to assure uniformity of regulations. The agreements are more specific in dealing with the prevention of water pollution than are the Ontario regulations. The prevention of water pollution was of prime concern to the Pennsylvania authorities and some of the lease provisions to protect water resources include the following:

1. Prior to any drilling operation, all State and Federal agencies having jurisdiction must approve of the plan for operation. These agencies include the Pennsylvania Sanitary Water Board and Fish Commission. The Department of Forests and Waters retains the right to take any steps necessary at any time to prevent pollution. No waste materials of any kind may be disposed in the Lake and any potential source of pollution will result in closing the operation until the hazard is removed.

2. Bonding and liability requirements include reimbursement for any damage to the Lake or its shoreline and a bond to cover permanent abandonment of each well.

3. Technical requirements for drilling include adequate control of drilling fluids, blowout preventors, casing, marking and identifying each well. Casings must be leak tested at the first show of gas or oil and wellheads and pipeline specifications are designed to prevent pollution from damage to equipment.

4. Drilling is not permitted in restricted zones one mile from water supply or waste outfalls and within a zone varying from two to eight miles from the shoreline.

In addition to the requirements of the leases issued for offshore drilling in Pennsylvania, a permit must be obtained from the Oil and Gas Division of the Pennsylvania Department of Mines and Mineral Industries before any well can be drilled. This permit is required in accordance with the provisions of the Pennsylvania Gas Operations, Well Drilling, Petroleum and Coal Mining Act of 1955 as amended.

New York

The state of New York conducted a public hearing on proposed rules and regulations for offshore oil and gas drilling in Lake Erie on April 28, 1969, in Buffalo. The proposed regulations include a bonding provision of $20,000 per well for plugging and abandoning costs and require liability insurance as do the requirements of Ontario and Pennsylvania. Wellheads must be set at or below lake bottom, and the operation must comply with the Water Quality Standards of the Water Resources Commission of the State of New York. Wells must be plugged by complete filling with cement.

Testimony was taken at the April 28 hearing and the proposed rules and regulations have been approved by the Department of Conservation. Bids were solicited for leasing of underwater lands but were subsequently cancelled pending consideration of proposed U.S. Federal rules and regulations.

Ohio

Leasing of offshore acreage by the state of Ohio has been deferred pending a determination by the Ohio General Assembly, and no further consideration of offshore drilling can take place in Ohio until enabling legislation is enacted. Officials of the state of Ohio participated in the development of regulations for the other jurisdictions and it is anticipated that if offshore drilling is eventually permitted in Ohio, regulations compatible with other jurisdictions will be adopted.

Michigan

The State of Michigan has had a long-standing policy against the granting of leases of state-owned bottom lands in the Great Lakes for offshore drilling for oil and gas. No change in this policy is anticipated at this time, especially in view of the extensive damages that occurred at the recent Santa Barbara channel oil spill. Officials of the State of Michigan have, in participation with their counter-parts in Ontario, agreed to a further policy relative to the granting of permits in the international boundary waters in Lake Huron, St. Clair River, Lake St. Clair and the Detroit River. No regulations pertaining to offshore drilling have been developed as of this date because of existence of these two policies.

Adequacy of Regulations

An extensive review of offshore drilling regulations has been made, and it is concluded that they can provide adequate protection of the water resources of the Lake if adequate and effective surveillance and enforcement is also provided. If drilling is extensive, accidents may occur and the development of contingency plans is needed to cope with such incidents. Pennsylvania has begun aquatic biota surveys of potential drilling sites. These surveys will provide a baseline from which to measure changes that may be caused by offshore drilling.

Some problems are anticipated in providing adequate surveillance of drill sites. A high degree of co-ordination between interested agencies will be necessary to provide adequate but not repetitious coverage.

TECHNICAL ASPECTS OF THE CONTAINMENT AND CLEAN-UP OF OIL SPILLS

Many materials of a physical and chemical nature have been used to combat the pollution caused by losses of oil to bodies of water. Similarly, various procedures and types of equipment have been tried or proposed for the prevention of damages or for the clean-up after an oil loss has occurred. These will be discussed in this chapter with their advantages and shortcomings.

Oil on Water: Containment

By transfer of cargo.

One of the most important potential causes of pollution by oil or other hazardous materials is that arising from ship collision or stranding. Leaving aside damage control or salvage, which are beyond the scope of this report, a possibility to be considered seriously is the transfer of fuel or cargo from a damaged vessel into tanks aboard another vessel.

The logistics of this operation are formidable; more often than not, success will depend on a race against time, calling for rapid deployment of the receiving vessel together with pumps, floating hose lines, etc., capable of handling several hundred tons per hour of dangerous (highly inflammable) liquids.

A radical solution would be to maintain a number of tanker hulks (or other bulk cargo vessels) at strategic locations in the Lakes. These hulks would be towed to the scene of an accident. Meanwhile, a single set of pumps and hoses would be stored in a central depot ready for transshipment by truck to the port nearest the scene of operations where it would be put aboard a tug or a barge. With good planning, the time delay between mobilization and action should be in the order of 12 hours. (A relatively short time considering the operations involved)

It is realized, however, that the feasibility of such a solution requires extensive investigation.

By mechanical barriers

The density difference between oil and water, and the immiscibility of the two fluids makes it possible to confine an oil slick on the water surface with a floating barrier. In calm conditions the only requirements are that the barrier be oil-proof and that it have sufficient draught and freeboard to extend above and below the pool of oil.

Under natural conditions, severe difficulties may be encountered. Waves may slop oil over the barrier as well as induce large stresses in its mechanical support. Water currents relative to the barrier and directed perpendicularly to it may either drag oil under the barrier or else push oil over the top. The rigging, positioning, and mooring of a long boom can be an awkward task.

A successful floating barrier must have the following properties:

(1) Sufficient freeboard and draught to operate under conditions of waves, wind and current.

(2) Sufficient mechanical strength to permit the use of long lengths.

(3) Simple to launch and retrieve, both from the shore and from small boats.

(4) Inexpensive.

Most booms employ a float-like superstructure from which is suspended a weighted curtain. One of the more successful designs, the 'T-T' boom* employs a flexible fabric curtain, weighted along one edge which is held up by small, detachable floats. The curtain may be stored either folded or rolled and the floats are clipped on as the boom is launched over the stern of a small boat. The boom is supplied in sections of 164 feet which can be joined end-to-end to form the required length. (Fig. 3)

Another barrier technique is the creation of the surface current on the water which holds back the oil. The current could be initiated in a variety of ways but the most common is to employ the twin-vortex circulation set up by a line of rising air bubbles (Fig. 4). This barrier has the considerable advantage that ships can pass through it without hindrance.

*Trygne Thune A/S, Oslo, Norway.

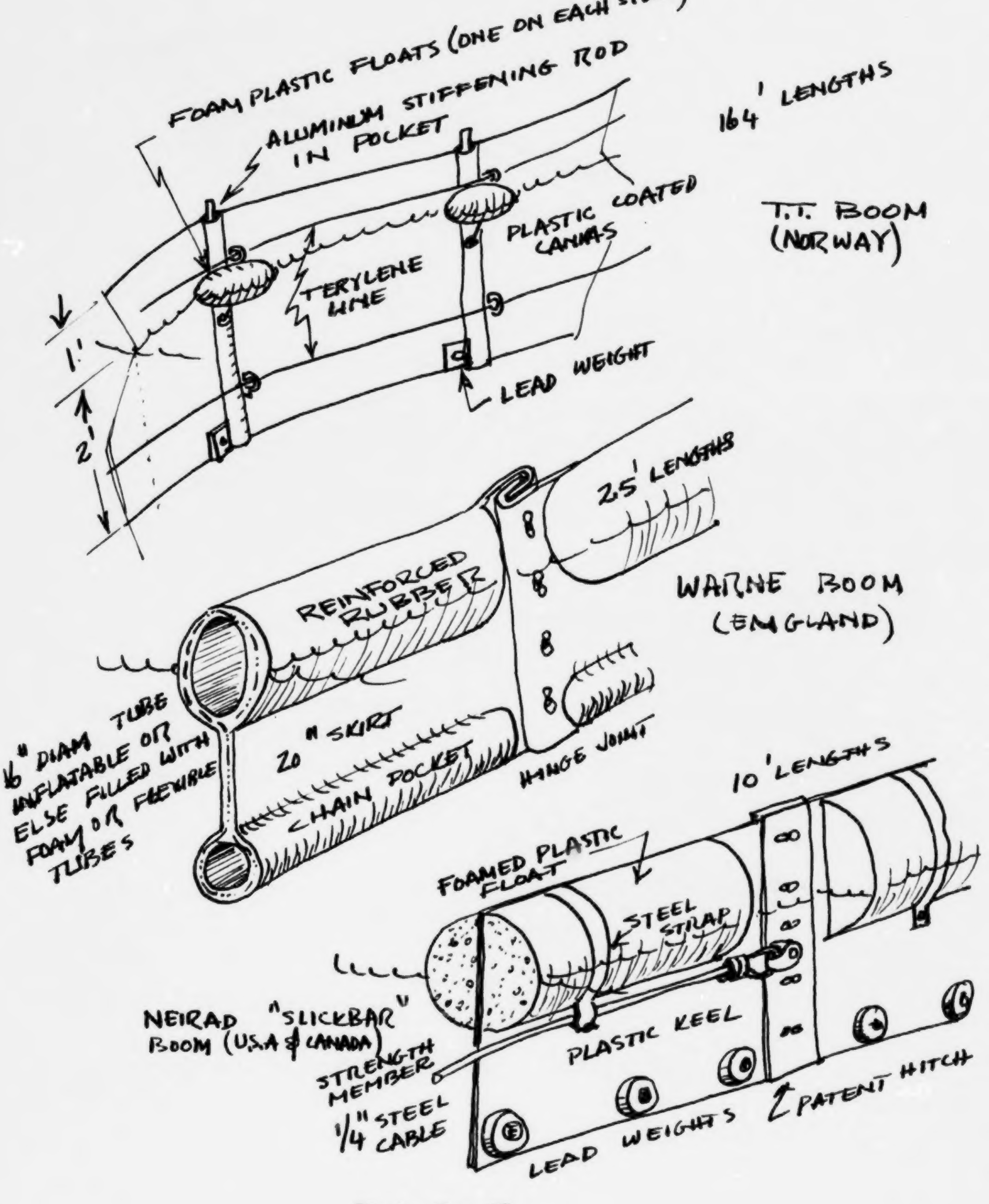
FOAM PLASTIC FLOATS (ONE ON EACH SIDE)
ALUMINUM STIFFENING ROD IN POCKET
164' LENGTHS
PLASTIC COATED CANVAS
T.T. BOOM (NORWAY)
TERYLENE LINE
1'
2'
LEAD WEIGHT
25' LENGTHS
REINFORCED RUBBER
WARNE BOOM (ENGLAND)
16" DIAM TUBE INFLATABLE OR ELSE FILLED WITH FOAM OR FLEXIBLE TUBES
20" SKIRT
CHAIN POCKET
HINGE JOINT
10' LENGTHS
FOAMED PLASTIC FLOAT
STEEL STRAP
NEIRAD "SLICKBAR" BOOM (U.S.A & CANADA)
STRENGTH MEMBER
1/4" STEEL CABLE
PLASTIC KEEL
LEAD WEIGHTS
PATENT HITCH

FIGURE 3

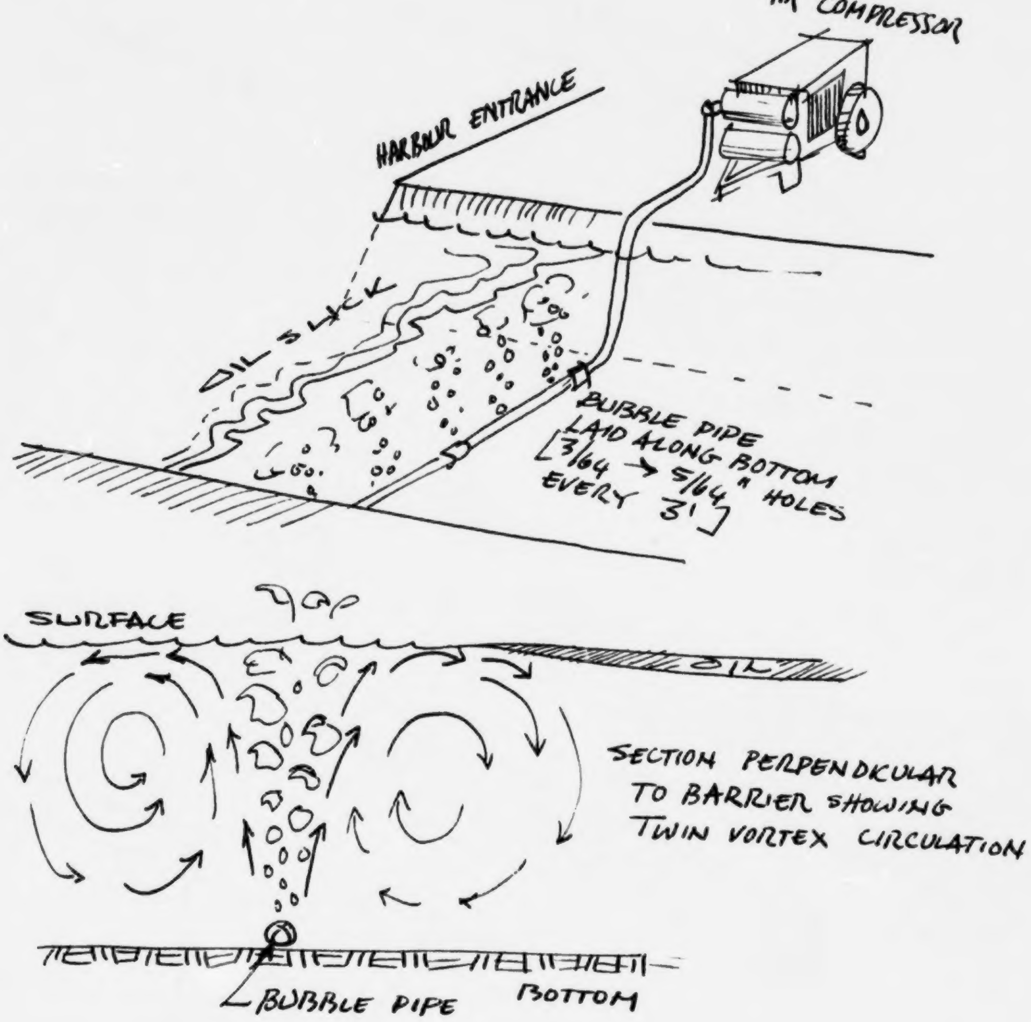
AIR COMPRESSOR
HARBOUR ENTRANCE
OIL SLICK
BUBBLE PIPE LAID ALONG BOTTOM [3/64 → 5/64" HOLES EVERY 3']
SURFACE
OIL
SECTION PERPENDICULAR TO BARRIER SHOWING TWIN VORTEX CIRCULATION
BUBBLE PIPE
BOTTOM

FIGURE 4
BUBBLE BARRIERS

Needless to say, no commercially available devices satisfy the requirements fully under all sea conditions. Some are more effective than others and doubtless better designs will be forthcoming. However, as an interim measure, it is recommended that:

1. Harbours and marinas should consider the purchase of enough oil boom to seal off their entrances from the lake with two separate barriers. The boom would also serve to prevent a spill that occurred in the harbour from reaching the lake. The cost of the boom should be weighed against the cost of cleaning boats, wharves and shores.

2. At least 1000 feet and preferably 3000 feet of barrier should be purchased and held in readiness as part of the contingency plan for oil spills. The barrier "kit" would also include ropes, anchors, and paravanes. The techniques of setting, manoeuvering, and retrieving the barrier should be tested in the field and a manual prepared from this experience.

and in addition,

(3) Research into barrier design and use should be conducted.

(a) Encirclement of the Source

A damaged ship or oil well could, in principle, be encircled by an oil boom in order to confine the spill and to concentrate it for easy clean-up. If this technique is to succeed, the boom must be deployed quickly and oil removal within the enclosure started at once. Otherwise a spell of bad weather may undo all the effort by either breaking the boom or else by driving the oil over it. If the spill is at all large (greater than 500 tons say) then the boom should be long, at least 1000 metres. It is doubtful whether this technique could be more than partially successful due to the narrow set of conditions under which it could be applied. The circumstances of having 1000 metres of boom readily available and of having the spill occur during a period of calm weather are not likely to arise. The encirclement of a chronic source of pollution such as might exist with an offshore well would permit the removal of some of the oil by skimming within the perimeter of the boom during periods of calm weather.

(b) Protection of Harbours

Probably the most successful use of floating oil barriers has been in sealing off harbour and estuary entrances against the intruding oil. In most cases the entrances are in sheltered water and only relatively short lengths of boom are needed. Usually there is no lack of boats to deploy and maintain the barrier. Harbours with exposed entrances or with a strong seiche (or river) current will be more difficult to protect.

Experience (particularly in Santa Barbara (4)) has shown that it is unwise to rely on one barrier alone. The best practice is to use several barriers, one behind the other, and to remove the oil by skimming or other methods, from between the barriers. In this way, sudden catastrophic failure of the defenses is avoided. The combination of bubble barriers and mechanical barriers, located to seaward of the boom would also serve as a breakwater*

(c) Protection of Shoreline

In principle, bathing beaches and other valuable stretches of shoreline could be protected by floating booms. The remarks in the foregoing paragraphs apply. In view of the long lengths of barrier needed and the exposure of open beach areas, this technique does not seem promising for general application.

In the presence of winds or currents, which induce along-shore drift of the floating oil, the use of short lengths of barrier as a form of offshore groining could reduce the shore clean-up considerably (5). This technique is illustrated in Fig. 5. The drifting oil is concentrated and collected onshore on a relatively short stretch of beach (chosen for convenience). A short barrier can protect a much longer length of shoreline. Adaptations of the "guiding technique" could be used offshore.

(d) "Trawling and Seining"

The use of floating barriers as a form of oil "trawl" to concentrate oil slicks for removal by other techniques is an obvious application. Once again, the basic physics of oil containment apply, with the added difficulty that the flow of water relative to the barrier will tend to draw the oil over or under the barrier. A "purse seining" technique might

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*Short wavelength free surface gravity waves are strongly attenuated in passing through a bubble barrier.

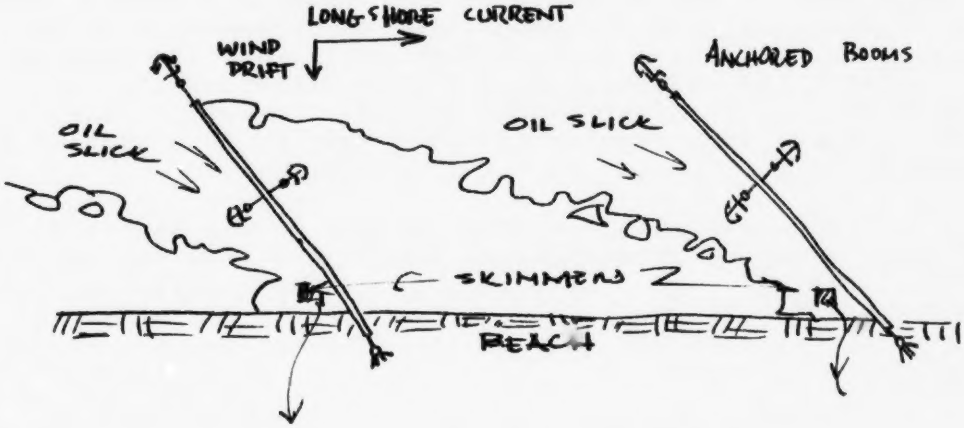

LONGSHORE CURRENT
WIND DRIFT
ANCHORED BOOMS
OIL SLICK
OIL SLICK
SKIMMERS
BEACH

FIGURE 5

USE OF FLOATING BOOMS TO PROTECT SHORELINE WHEN THERE IS AN APPRECIABLE LONGSHORE CURRENT be considered when the boom is sufficiently long to encircle a patch of oil. The "seine" could be allowed to drift with the prevailing currents while the oil was being concentrated and removed.

Oil on Water: Removal

Use of Mechanical Methods

(a) Skimming and Slurping

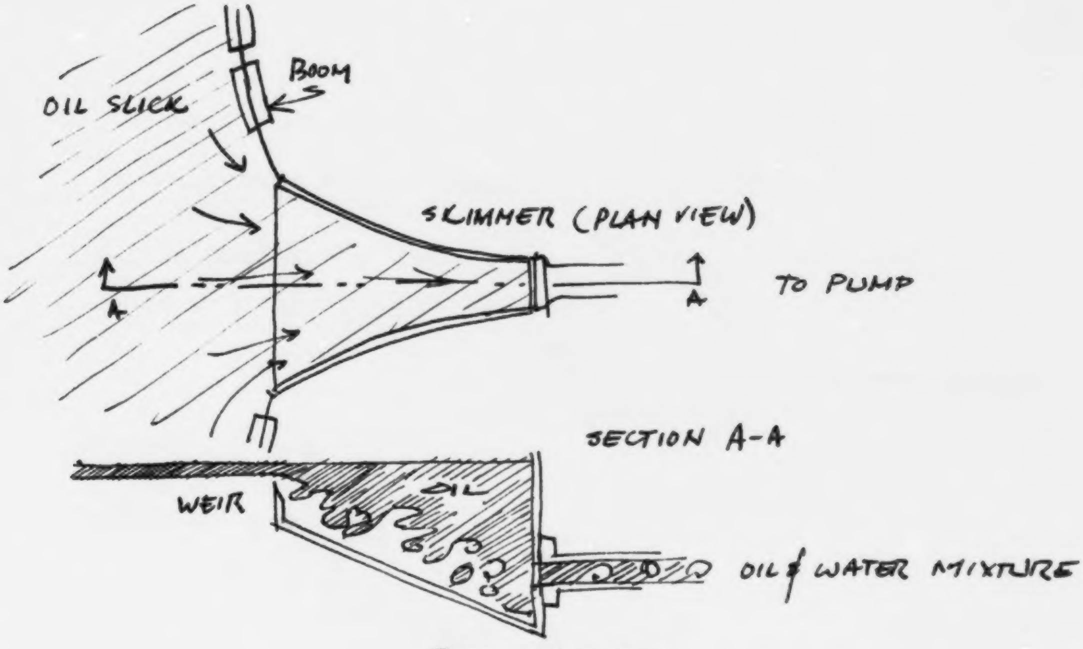
These techniques involve removing the surface layer of water and the oil floating on it. Usually a pump is used to move the fluid and the pump inlet is designed so as to maximize the oil/water ratio of the fluid. If the pump is self-priming and can tolerate air-water mixtures then a vacuum-cleaner type inlet might be considered. Normally, large capacity pumps will require an inlet sump of some kind so as to avoid the entrainment of air (Fig. 6).

Other skimming devices operate in the manner of a dust pan; a moving skimmer blade scoops oil from the water surface (Fig. 6). Still others employ an oil wettable absorbent material which is dragged over the oil slick and then wrung out into the holding tank of the recovery vessel (Fig. 7).

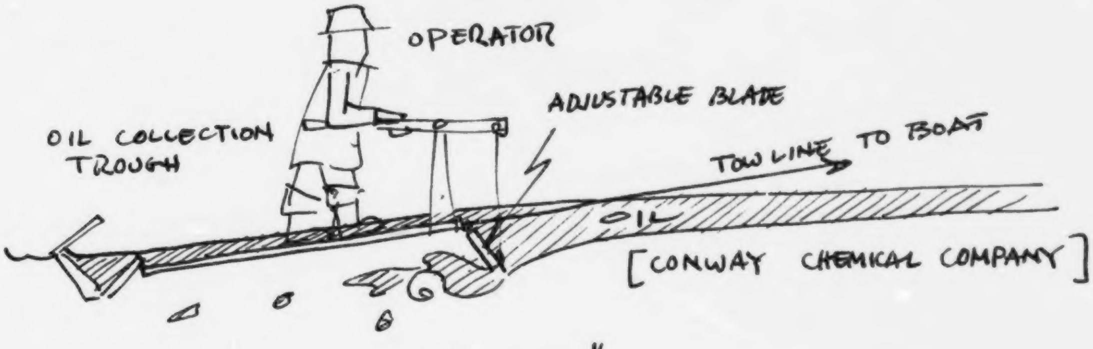
Because the oil/water recovery ratio is at best small, an important auxiliary to a skimming device is a settling tank where the oil-water mixture can be allowed to separate and the water drawn off the bottom and discarded.

With the exception of the sponge-type skimmers, the other devices operate on the assumption that the oil-water interface is a horizontal plane; they perform poorly in agitated conditions. The efficiency of the system depends too on the nature of oil; a free flowing oil is more easily skimmed than a viscous oil. The oil/water ratio and the recovery rate are augmented by an increase in the thickness of the oil pool. Paravanes and oil-proof booms may be used to increase the thickness of the oil pool at the entrance to the skimmer.

Most of the commercially available skimmers are designed for refinery waste water holding ponds or clean-ups in harbours where small quantities of oil are recovered under calm conditions. The "sponge" type machines are easily damaged by floating debris picked up along with the oil.


OIL SLICK
BOOM
SKIMMER (PLAN VIEW)
A
A
TO PUMP
SECTION A-A
WEIR
OIL
OIL & WATER MIXTURE

PUMP OPERATED SKIMMER


OPERATOR
ADJUSTABLE BLADE
OIL COLLECTION TROUGH
TOW LINE TO BOAT
OIL

[CONWAY CHEMICAL COMPANY]

"DUST PAN" SKIMMER

FIGURE 6

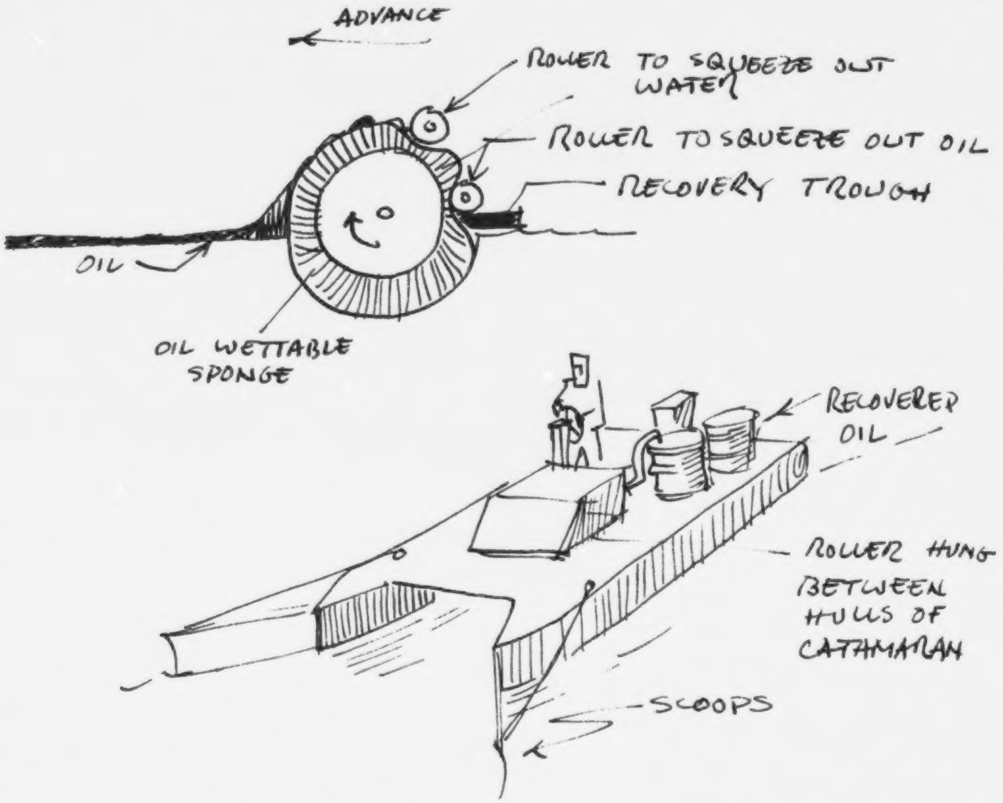

ADVANCE
ROLLER TO SQUEEZE OUT WATER
ROLLER TO SQUEEZE OUT OIL
RECOVERY TROUGH
OIL
OIL WETTABLE SPONGE
RECOVERED OIL
ROLLER HUNG BETWEEN HULLS OF CATHMARAN
SCOOPS

FIGURE 7

For the clean-up of nearshore regions and harbours it is possible to adapt pumping vehicles such as those used to clean septic tanks and sewers. For efficient oil recovery it would be advisable to construct low velocity pick-up nozzles; some experimentation might be worthwhile to develop a pick-up nozzle which could be made up in short order out of sheet metal and plywood. By pumping for intervals, allowing the oil-water mixture to settle, and then draining off the water from the bottom of the tank, it would be possible to increase the amount of oil recovered per truckload.

For the skimming offshore of large quantities of oil there does not appear to be a source of readily adaptable pumping equipment. One might consider emergency lashups of pumps and tanks on scows but unless the person designated to direct the clean-up operation *(on-scene commander)* knew in advance where to secure suitable equipment, there would be only a small chance of success.

Use of Physical and Chemical Materials

(a) Adsorbing and Coagulating

The main purpose of this technique is to give the floating oil a "handle" either by absorbing (or adsorbing) it with a particulate solid or else by treating it with a chemical substance which causes it to thicken or gell. The oil may then be removed by lifting it (and the absorbants) from the water surface with a seive or a rake (as opposed to pumping). This discussion will be restricted to the use of absorbants or adsorbants since general purpose coagulants are not yet available.

The best adsorbants or absorbants are those materials which are wetted preferentially by oil. Needless to say, they must float. Several materials have been successfully employed; among them are straw*, wood shavings, sawdust, bark, leather shavings, chipped polyurethane, steam-expanded pumice.

The adsorbant is spread on the slick surface from a boat, allowed to act on the oil surface, and then the oil and adsorbant are removed together. Another method consists of forming a boom of loosely woven sacks filled with adsorbant and then dragging the boom through the oil slick. Chickenwire or fish net could be used to form the supporting structure of the boom. The disadvantage of this scheme is the necessity of replacing the oil adsorbent material as its adsorbent capacity is used up.

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*The straw must be new - old straw loses its adsorbent characteristics.

For spills of heavy bunker oil in cold water, in which the oil forms tarry globs, neither slurping nor adsorbants will be effective. A porous "sweeping" boom made of fish net or wire mesh might be useful.

One aspect of the use of adsorbants which deserves special mention, is that of disposing of the oil-soaked adsorbants. Some of the plastic materials, inert to normal processes of decomposition will give off poisonous fumes when burned and so must be buried permanently.

Generally speaking, the successful use of adsorbants is less dependent on weather conditions and more suited to improvised means than other techniques.

One adsorbent material, straw, offers many advantages:

(1) It is available in quantity and at short notice

(2) It is cheap

(3) It is easily handled in bales and is non-toxic

(4) Farm and road building machinery can be used to spread it (mulchers and spreaders)

(5) It can be raked and gathered with simple instruments (rakes, pitchforks)

(6) It can be destroyed by burning without releasing poisonous fumes - it will rot naturally left to itself.

(7) Fresh straw can absorb up to 5 times its own weight in oil.

The technique adopted in Santa Barbara was to spread straw on floating oil using highway mulchers set on the decks of small boats. A 40 ft. launch with good open deck space (10 ft. x 10 ft.) would be adequate. Wind and wave action serve to mix the straw and oil together. In the Santa Barbara case, the battle was waged just off the beach as the oil was being blown ashore by the wind. In other cases it might be possible to impound the straw and oil mixture with a floating barrier.

(b) Sinking and (c) Dispersing

These two methods of treating oil slicks amount to hiding the oil in or under the water and then relying on assimilation through natural biodegradation. In one method, sinking, the oil is weighted with a granular material (sand, crushed limestone) and sunk to the bottom; in the other, the oil is broken down into tiny droplets by a dispersant*; mechanical agitation then produces an emulsion of oil in water. The two methods have two disadvantages in common:

(i) The oil slicks may reform later;
(ii) Harm may be caused to aquatic organisms.

(b) Sinking

The sinking agent is usually a granular material more dense than water, which has been treated with a substance which renders it preferentially wettable by the oil. Carbon-coated sand grains, and crushed limestone treated with sodium stearate (5) have been used with success. The material is sprinkled on the floating oil (a highway sand-spreader might be adapted to this task) from the deck of a ship. The spreading density would of course depend on the nature of the oil and on the size of the grains. This method would be more suited to a viscous, weathered oil, since the grains would tend to sink rapidly through a thin oil carrying very little oil with them.

It is possible that the sinking of the oil might only be temporary, that the oil (or some of it) might work free and rise to the surface. The experience gained during the Torrey Canyon incident when the French sank some 20,000 tons of oil with powdered limestone has been that none of the oil reappeared. This is not conclusive proof of the efficacy of the method but it is encouraging.

The second objection is more serious, since the blanketing of the bottom with oil and sinking agent could be directly harmful to the benthic organisms and indirectly harmful to the entire biomass. While these arguments would certainly be important if the area concerned were a spawning ground for valuable fish or if it were a shell fish bed, they do not apply with the same force to Lake Erie. Insofar as the actual suffocation of the bottom is concerned, it is unlikely that the coating of oil and sinking agent on the bottom would be anywhere near uniform and also it is unlikely that the slicks from even a sizeable spill would cover more than a small fraction of the total surface area of the Lake.

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*Dispersants act so as to reduce the surface tension of the oil/water interface.

(c) Dispersing

Dispersants act on a floating oil slick by reducing the surface tension of the oil/water interface. The film of oil spreads out, and if mixing energy is applied, forms tiny droplets dispersed in the fluid. The desired end product is a stable oil-in-water emulsion which will be rapidly diluted and ultimately destroyed by bacterial action.

The formation of a stable emulsion depends on, one, the application of the correct quantity of the dispersant, and two, the addition of enough mixing energy to break up the treated slick into small droplets. The correct quantity of a particular dispersant is a function of the nature of the oil itself, and of the surface temperature of the water. In general, the dispersant/oil ratio is greater for heavier oils and for colder temperatures. Typical ratios are 1/6 by volume. Mixing energy may be supplied by the winds and waves, by the ship propeller wash, or by jets from fire hose nozzles. The down-wash from a helicopter rotor may be effective as well.

Unfortunately, the formation of a stable emulsion is not the only difficulty in using dispersants. Experience has shown that one must reckon carefully with their effects on the flora and fauna in the water. Products widely used during the Torrey Canyon spill turned out to be highly toxic to life even in very small concentrations. Research following the disaster has produced dispersants which are far less toxic by themselves, but the emulsions formed by them have nevertheless proven to be dangerous.

A number of researchers have studied the toxic effects of dispersants and the emulsions they form (6), (7) and (8). Most of the tests consist of observing the percent of fatality among samples of minnows exposed for varying lengths of time to varying concentrations of dispersant solutions or oil/dispersant/water emulsions. It is clear that some dispersants present less of an immediate hazard to life than others but the tests cannot be considered as indicative of the long-term effects of exposure to the chemical or its emulsions.

In Lake Erie, the effects of the emulsions must be considered not only on the organisms in the Lake but also on the palatability of water entering the many municipal intakes. In view of the scanty knowledge we now possess, caution would be prudent.

Dispersants are useful in reducing the fire hazard of spilled oil. Their use in harbours and around oil rigs may be justified in view of the potential danger to life and property.

They are best applied from the deck of a ship using a fire-hose eductor system which enables the correct dilution of the primary material (in barrels) to be obtained without prior mixing and storing. The dispersant is sprayed in a fine mist and allowed to fall on the oil slick. After an interval of time sufficient to allow the dispersant to act, the upper layers are agitated with the ship's propellers or with a strong jet from a fire hose (the latter is better).

In summary, the following conclusions and recommendations are made:

1. *Pending the development of improved skimming methods, the best way of mechanically removing large quantities of free-flowing oil from the water surface is with an adsorbent material, straw in particular. The immediate contingency plan should include a list of sources of straw spreading equipment and straw itself.*

2. *For inshore clean-up of marine oil pollution (beaches and harbours) the adaptation of sump pumping trucks should be considered. Some experimentation will be necessary to develop an efficient suction inlet.*

3. *Research should be undertaken in the design of large capacity skimmers for offshore work.*

4. *For the offshore disposal of heavy oils, sinking with crushed limestone or carbon-treated sand is a technique which should be seriously considered. An investigation is required of the suitability and availability of the materials and the tools to spread them. Other experiments which must be undertaken concern the effect of sunken oil on the bottom fauna. If the results of these experiments are favourable, this method may be the best for dealing with large offshore spills.*

5. Dispersants should be restricted to offshore applications except in cases where life and property are in danger from explosion or fire. Dispersants will be more successful with light oils than with heavy ones.

Oil on Shore

Protection of Shore Areas

If a large quantity of oil is spilled, it is certain, no matter how vigorous the campaign offshore, that some of it will come ashore. In Lake Erie it is probable that oil will find its way to the beach within 48 hours of the spill. In some cases it may be possible to protect the shoreline with floating barriers. This protection will be at best partial and temporary, and will require a major effort. Most often, the best course of action will be to prepare the shoreline for the oncoming oil in order to simplify the task of removal.

One method which can be applied to all types of shoreline is to spread oil adsorbent material on the water just beyond the zone of wave breaking. The oil and adsorbant are carried together onshore after being well mixed in the breakers. Alternatively, adsorbent materials can be spread on the wave run-up zone of the beach from onshore. The objective is to prevent as much as is possible the penetration of the shore material by the oil. The best adsorbants are straw or wood shavings which can be gathered up with garden rakes, etc. Natural debris washed up on the beach from previous storms can be used as an adsorbent material by raking it into the wave run-up zone. The oil-soaked material can be gathered and removed and fresh adsorbant applied as required.

If the shore consists of sand or other loose material it may be useful to shorten the wave run-up zone by bulldozing beach material (Fig. 8). This measure is not likely to be successful in the face of a storm but under moderate conditions it should reduce the width of the contaminated area of the shore.

In most cases it will be wasted effort to attempt to protect a rocky coastline since the task of removing or of spreading adsorbants is considerably more difficult. These areas are usually of lesser importance. It should be borne

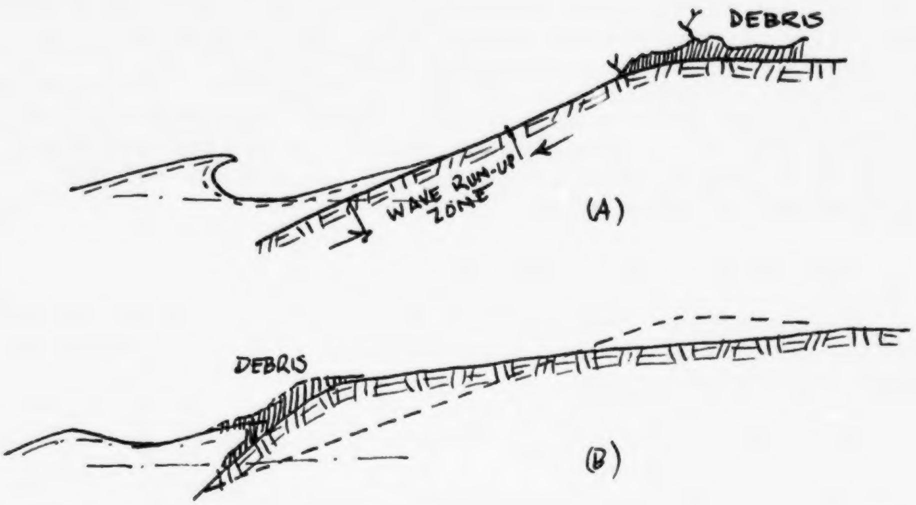
DEBRIS
WAVE RUN-UP ZONE
(A)
DEBRIS
(B)

FIGURE 8

METHOD OF LIMITING OIL DAMAGE TO A BEACH
(A) NORMAL PROFILE
(B) PROFILE AFTER BULLDOZING BEACH MATERIAL AND DEBRIS INTO WAVE RUN-UP ZONE

in mind that the damage to shorelines from oil alone is purely aesthetic and that natural decomposition will remove it within one or two years (9).

The protection of waterfowl nesting grounds and of the birds themselves is a topic of concern and must be studied in the light of specialized knowledge of the birds and their habits.

In the event of a large spill it will be impossible to protect all the threatened shoreline. A necessary item of a contingency plan is a detailed inventory of the resources (beaches, harbours, wildlife sanctuaries, etc.) along the shore together with a set of priorities governed by the importance ascribed to their protection. A useful planning tool would be a set of low altitude air photos in colour of the shoreline of Lake Erie.

The Inevitable Clean-up

The possible combination of types of shoreline and types of oil are many and as yet, no hard and fast rules or procedures can be set down.

(a) Beaches

Through wave action alone, the oil will be spread across a band some 10-20 feet wide (depending on the slope and the sea state). The absence of tides confines the pollution to a narrow strip; but at the same time the clean-up must be carried out in the wave run-up zone; there is no low tide to give access to a wide area of beach.

The techniques used to clean up or remove the oil will depend on the nature of the oil and the beach material; in particular, they will depend on the degree to which the oil penetrates or adheres to the beach material. If the oil comes ashore on a wet sand beach under moderate conditions, little penetration is likely. (This was observed in Santa Barbara). If, however, the oil is driven ashore in a heavy surf, it is possible that beach material will be deposited over it and the oil buried. The buried oil then would seep slowly to the surface resulting in a continued pollution of the beach. Oil on a shingle beach would be an unhappy affair since penetration is bound to occur despite the repelling effect of the wet beach material.

If possible, the oil should be removed from the beach as it comes ashore. The vacuum hoses from septic tank pumping trucks (fitted out with a suitable inlet orifice) could be used to good effect in areas where the machines can be manoeuvered near enough to the shoreline. The most reliable method would be to mop up the oil with adsorbent material (straw, natural debris) in the run-up zone, gathering the oil-soaked material into piles for subsequent removal. When the last of the oil has been blown ashore, the contaminated layer of beach material itself can be removed.

This operation is time-consuming and expensive; in Santa Barbara the efforts of 50 men armed with rakes, supplied with straw, and supported by two or three front end loaders and 10 dump trucks were required to clean up a mile of sandy beach in a day.

During the clean-up operations subsequent to the Torrey Canyon spill, much use was made of dispersants to clean sand and shingle beaches. Descriptions of the methods can be found in reference (9). This treatment is not recommended for the following reasons:

(i) High concentrations of oil/dispersant/water emulsions are formed inshore

(ii) The use of dispersants on a sandy beach will hasten penetration of the beach materials by the oil due to the decrease in surface tension of the water. In extreme cases a quicksand may be formed.

(iii) The proper use of the dispersants depends on the rise and fall of the tide; the dispersants are applied just ahead of the rising tideline.

(iv) Another aspect to be considered in the use of dispersants is the cost of treating a large amount of spilled oil at the typical ratios needed for effectiveness. This cost would have to be compared with the resulting expense if the oil were to reach a harbour, waterworks or beach.

(b) Rocky Shorelines and Seawalls

The clean-up of rocky, inaccessible shorelines will be expensive. Solace may be drawn from the experience that if the oil is untreated with dispersants and the like, natural weathering and degradation will remove it in a year or so with no great harm resulting. When it is necessary to remove oil from rocks, seawalls, and wharves, steam cleaning equipment set to deliver a jet of hot water (50°C) will effectively dislodge weathered oil. Some provision should be made to recapture the oil. A proposal is sketched in Fig. 9. Time is an ally in this venture and action should be undertaken at the very last when all the free-floating oil has either come ashore or has been recovered.

(c) Harbours and Marinas

The task of cleaning oil from the clutter of wharves, floats, boats, etc., in a harbour is particularly awkward and every effort should be made to seal off these areas with floating barriers before the oil arrives. The use of dispersants may be necessary if the spilled petroleum results in a fire hazard. Clean-up should be deferred until it is certain that no more oil will enter the harbour (the source of pollution is stopped or else the harbour is sealed off with a barrier).

The technique adopted in Santa Barbara harbour was to spread straw by hand on the patches of oil from punts and rowboats and then to lift the oil-soaked straw from the water with a "paddle" rake (4) (Fig. 10). The oil-soaked straw was collected ashore and loaded into trucks for disposal. The method is laborious but well-suited to the confined spaces of a small harbour.

In summary,

1. *Adsorbants, straw in particular, to remove the free oil, followed by removal of the contaminated beach material offer the best means at present of cleaning a beach.*

2. *Oil should be left to weather and decompose naturally on a rocky shoreline, with the exception of areas of intensive public use.*

Disposal of Recovered Oil and Oil-Soaked Material

Although this topic lies somewhat beyond the immediate concern of this report, it is one which should be considered in detail by any realistic contingency plan. The clean-up operations in Santa Barbara were slowed because no suitable area could be found for the disposal of many tons of oil-soaked straw.

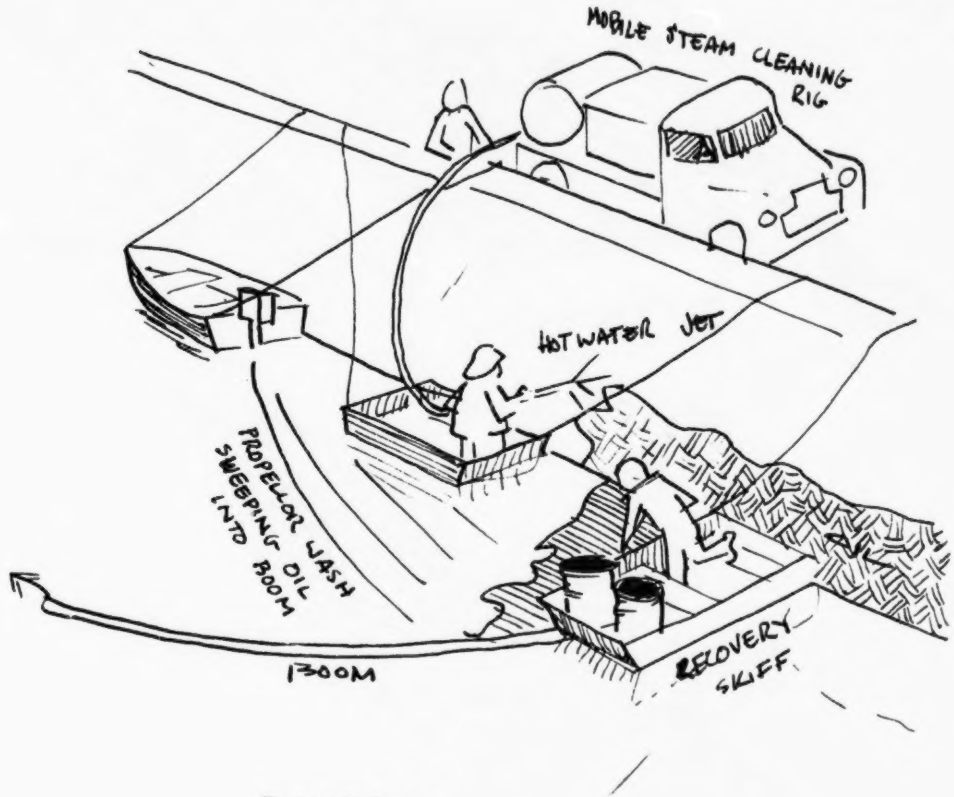
MOBILE STEAM CLEANING RIG
HOT WATER JET
PROPELLOR WASH SWEEPING OIL INTO BOOM
BOOM
RECOVERY SKIFF

FIGURE 9

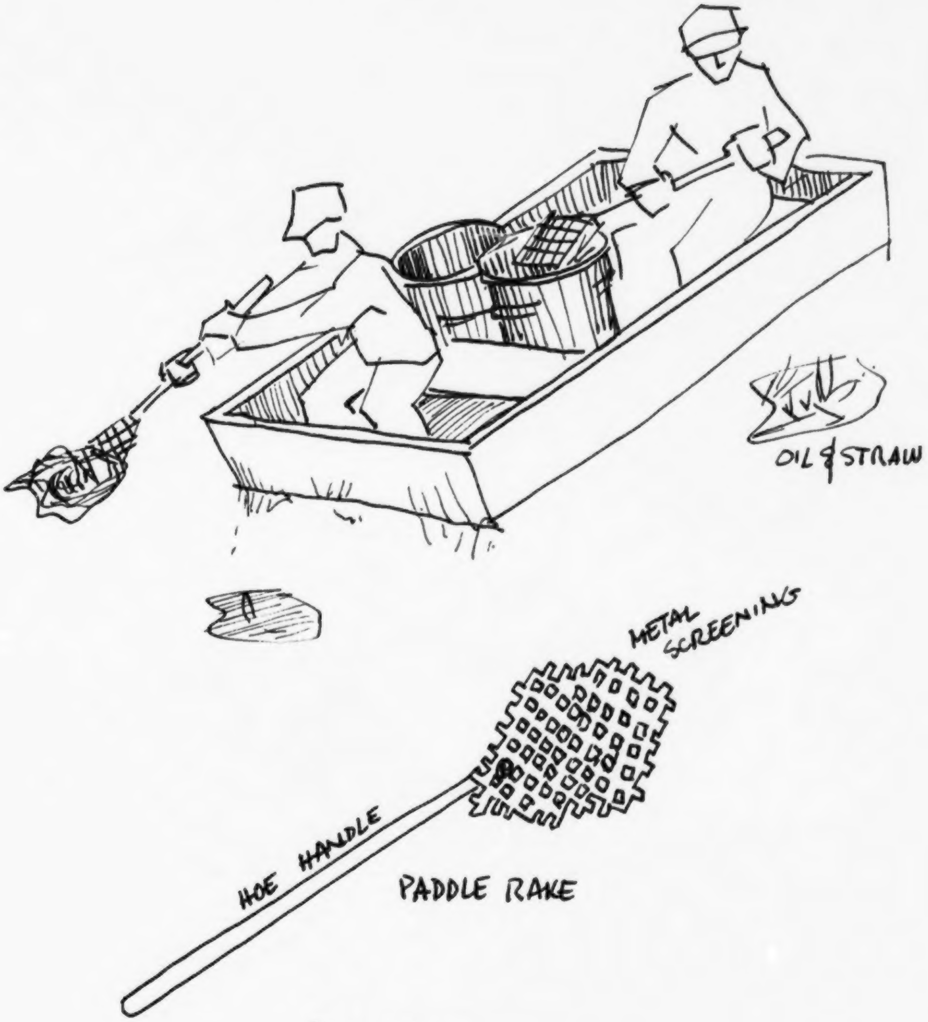
OIL & STRAW
METAL SCREENING
HOE HANDLE
PADDLE RAKE

FIGURE 10

The recovered oil will probably be in two forms, liquid *"slop"* oil from skimming or slurping operations, and oil-soaked adsorbent material or beach material. In some cases, the slop oil could be reclaimed and used. In this event a holding tank or pond must be provided ashore. For the ultimate disposal of the waste, two alternatives are open, burial or burning. Here the problem is one of avoiding pollution of different kinds. The location and nature of any burial pit must be such that seeping oil does not reappear. Burning oil wastes is likely to create much sooty smoke not to mentioned other smog-producing hydrocarbons. One must reckon too with the combustion products of the adsorbant; some of the plastic adsorbants give off poisonous fumes when burned. Decomposition with special petroleum feeding bacteria may provide a third alternative.

CONTINGENCY PLANNING

General Description

The purpose of contingency planning is to develop guidelines and establish procedures for marshalling response capabilities to minimize pollutional effects of spills on the water resource. Successful implementation of such plans reduces, and may even prevent impairment of water quality for accepted uses, and mitigates damages to aquatic life, human beings, and property.

A contingency plan, within the context of this report, assumes the probability and/or the possibility of a spill of oil into Lake Erie; not only from offshore drilling activity, but for spills of oil and other hazardous or deleterious substances, regardless of their origin.

The objectives of a contingency plan may be said to be:

1. To develop effective systems for discovering and reporting of a pollution incident.
2. To provide procedures for initiating and carrying out programs to restrict the spread of the pollutant.
3. To identify techniques for clean-up and methods of disposal of the collected pollutants, and where appropriate,
4. To initiate action to recover clean-up costs and assure enforcement of existing statutes.

Developing contingency plans which take into account the available resources of manpower, materials and equipment, and technology are an important first step in the handling of spills of pollutants, both large and small. Command and technological responsibilities must be predetermined as part of such plans in order to reduce confusion, misunderstanding and lost motion which usually occur whenever an emergency arises.

The Commission has been requested by the two governments to report on the *"adequacy of existing contingency plans and the action taken to implement them."*

Status

United States

Continency planning in the United States began in earnest in June 1968 when the President directed that multi-agency continency plans for responding to oil spill emergencies be developed for all coastal and major inland waterways. Such a plan, to serve as a guideline for regional plans, was developed by the Secretary of the Interior, with the Federal Water Pollution Control Administration acting as the lead and co-ordinating agency. These plans were developed with the co-operation of the Departments of Defense, Transportation, Commerce, and Health Education and Welfare, and the Office of Emergency Planning.

Contingency plans for the U.S. portions of the Great Lakes Basins have now also been substantially completed with the publication of the "Multi-agency Contingency Plan for Pollutional Spills in the Great Lakes Region", dated April 1969.(10) This more detailed plan was prepared by the Great Lakes Regional Office of the Federal Water Pollution Control Administration, Department of the Interior, in co-operation with the U.S. Coast Guard, U.S. Corps of Engineers, Office of Emergency Preparedness, U.S. Public Health Service, U.S. Fish and Wildlife Service, and U.S. Bureau of Commercial Fisheries.

The U.S. regional plan identifies the organization which is to provide a response mechanism to spills, and details the functions of the various elements or disciplines of the organization. It also provides details of the procedures for four response phases: discovery and notification, containment and countermeasures, cleanup, restoration and disposal, and recovery of damages and enforcement.

Appendices to the plan describe alerting procedures, identification of Regional Operations Team, on-scene Commanders' areas of responsibility, control and cleanup resources inventory, beneficial use areas, potential pollution sources, and other technical information.

One important conclusion can be reached based on the fact that such plans exist. There is a co-ordinated response capability now available in the United States, should an accidental spill occur in the U.S. portion of the Great Lakes Basins; this, aside from any consideration of its effectiveness or adequacy.

Canada

No comparable plan exists in Canada to-day. In the Canadian waters of the Great Lakes, the command and technological responsibility for action in case of material spills in general and oil spills in particular rests with the Ontario Water Resources Commission (OWRC). The Canada Department of Transport administers the "Oil Pollution Regulations, Canada Shipping Act" where spills from shipping have been involved or suspected. The OWRC over the years has established and maintained a reporting and communication system with U.S. federal and state pollution control agencies.

These arrangements were primarily designed to:

1. Identify the location and extent of the spill.

2. Advise parties which may be endangered by spills such as water works, recreational and wildlife areas so that they may take any protective action locally.

3. Mobilize available resources to identify source, determine steps necessary to prevent recurrence of spill and where necessary initiate legal action. This has required the assistance of the Canadian Department of Transport, the Ontario Departments of Energy and Resources Management and Lands and Forests, the FWPCA and the U.S. Coast Guard.

Over the years, the OWRC has gained considerable experience in dealing with material spills. During 1968 it was involved in over twenty incidents in the Great Lakes. A similar number were handled in the first seven months of 1969.

The Federal Department of Transport has recently developed an interim plan for use by officers of that Department in the event of large-scale discharges of oil in Canadian waters from ships.

Relating directly to the threat of oil pollution from oil and gas well drilling activities, the Ontario Department of Energy and Resources Management and the Ontario Gas Industry have developed an adequate line of communication and response. Boats and equipment are available which can be effectively and efficiently mobilized to correct and contain any pollution arising from drilling or production operations conducted within the known geological and reservoir conditions beneath Lake Erie. For a large spill, adequate equipment is not available.

The federal, provincial, industry response to the recently reported oil well leak in Lake Erie, which subsequently proved to be unfounded, demonstrated a significant capability, though unco-ordinated. Had the reported oil incident been of serious proportions it is unlikely that the individual resources of the agencies concerned could have been marshalled so as to bring the maximum possible capability to hear on the problem.

There are, however, the beginnings of a co-ordinated contingency plan taking shape. Some interagency discussions have taken place, and some planning is now in progress. There has also been some exchange of information through the technical Advisory Boards of the International Joint Commission.

Adequacy

Continency planning is a new and relatively untried tool of pollution control. The Torrey Canyon incident, as mentioned previously in this report, brought pollution control authorities and other government leaders throughout the world to an awareness of the absence of a capability to adequately cope with a major spill of a pollutant.

United States

More recently the task of dealing with a major oil spill - the Santa Barbara offshore oil well blowout off the California coast - has provided concerned Federal and State agencies with a valuable experience. When the blowout occurred in January 1969, U.S. regional continency plans had been developed to some degree, and an on-scene Commander had been appointed by the Coast Guard. While all facets of the plan had not been fully identified in terms of persons, agencies and locations, there was a sufficient awareness of the plan's procedures that a response mechanism quickly began to operate. While there were weaknesses and shortcomings, and voids in the implementation of the plan, it was the general post-crisis opinion that there had been some mitigation of the adverse effects of the spill, and that damages might have been considerably more extensive if such a plan had not been in existence.

On April 23, 1969, an oily substance escaped into the Trenton Channel from a Chrysler Corporation plant in Detroit, and several hours later moved into Lake Erie, via the Detroit River. Within a few hours after the spill was discovered and the contingency plan activated, all necessary government agencies had been notified, and respresentatives were on the scene. At the same time, the Chrysler Corporation had hired a private company to carry out containment and clean up operations, and it was determined by the *"on-scene commander"* of the contingency plan that that portion of the plan - containment and clean-up - was not required to be activated.

The experience, however, provides the basis for a partial assessment of the workability of the contingency plans. This experience seems to indicate that the plans are adequate, at least in terms of the procedures for reporting the spill and notifying various government elements with a responsibility for plan participation.

A considerably greater experience will be necessary before any meaningful assessment of the adequacy of the plans can be made. It may also be assumed that as experience is gained, any adjustments in the plans which might be indicated will be made. Thus there is a probability that any contingency plans for reacting to accidental spills of pollutants into the lakes will be constantly undergoing reviews to assure their adequacy and to reflect the "state of the art" in technological capability.

The U.S. Great Lakes regional contingency plans appear to cover all known steps in responding to accidental spills. Organization identification is precise and clear; delegation of responsibility is detailed, and the names of individuals, types and precise locations of materials, and participating agencies are identified.

There does appear, however, to be a concentration of responsibility on the federal establishment, which might be considered a weakness in the plan when assessed in the light of the Federal guidelines. The Federal guidelines contain the statement that "... this Plan encourages the development of State and local government capabilities and private capabilities to handle such pollution incidents." However, there appears to be little if any actual recognition of State and local capabilities, or delegation of responsibility in the Great Lakes regional plan. State and local capabilities are in fact significant. In addition, states bordering Lake Erie have a statutory responsibility in matters such as spills of pollutional materials.

The national guidelines also point out that "specific details concerning State, local and private involvement in response operations for pollution incidents will be spelled out in the regional plans." The Great Lakes plans do not accomplish a degree of specificity that could be expected.

Canada

Contingency planning in Canada at a national level has been seriously considered only since the Santa Barbara incident in California. Since then, several Federal Agencies have initiated consideration of the problem as it affects Canadian waters and there has been some drafting of preliminary plans for particular types of incidents. Although a national contingency plan is now being developed, a review of these activities indicates that substantial progress has yet to be achieved.

The contingency arrangements in the Great Lakes Basin, administered by the OWRC have been effective in maintaining surveillance and notification. Only limited success has been had in the manipulation of available resources for the containment and cleanup of oil spills. Fortunately, to-date organized large-scale clean-up operations have not been required. In cases where such a possibility existed the use of facilities available in the U.S. were considered.

The above shortcomings have been fully recognized not only by the OWRC and federal agencies but also by other groups directly concerned with oil spills such as industries which would carry the liability for damages arising from spills, and the Canadian Department of Transport which is directly involved in the prevention of spills from commercial vessels and the Ontario Department of Energy and Resources Management responsible for oil and gas well development.

Because of Ontario's unique position whereby it borders on all the Great Lakes, excepting Lake Michigan, it is apparent that Ontario should continue to play a lead role in any regional plan developed under a national contingency plan to deal with major spills originating from the Ontario side of the Great Lakes. Discussions have been initiated by the OWRC with the various industrial groups and government agencies with the view of developing a local plan for clean-up operations. Such plans will serve as the basis for local plans developed throughout the Province and will be compatible with multi-agency contingency plans developed nationally and with the plans currently in existence on the United States side.

Acknowledgements

The Board is indebted to the federal, provincial and state agencies that contributed to this report. Extensive use was made of the publications "Oil Pollution - A Report to the President," by the Secretary of the Interior and the Secretary of Transportation Feb. 1968., and "Offshore Drilling in Lake Erie" A report to the Sanitary Water Board, by the Bureau of Sanitary Engineering, Pennsylvania Department of Health, October 16, 1968.

Individuals deserving special notes of appreciation are Mr. D.A. Lazarchik, Chief, Industrial Wastes Section, Bureau of Sanitary Engineering, Pennsylvania Department of Health, Mr. R.G. Wayland, Chief, Conservation Division, U.S. Geological Survey, Department of the Interior, Mr. M.D. Bell, Conservation Engineer, Resources Administration Division, Department of Energy, Mines and Resources (Canada), and Mr. D.A. Sharp, Supervisor, Petroleum Resources Section, Ontario Department of Energy and Resources Management.

The contribution of Mr. F. Boyce, Scientific Officer-Physical Limnology Section, Great Lakes Division, Department of Energy, Mines and Resources, Canada Centre for Inland Waters, is particularly worthy of comment. Mr. Boyce is responsible for the section of this report dealing with the technical aspects of the containment and clean-up of oil spills, which is based on his own experiences in France at the time of the Torrey Canyon disaster, and also from his observations of the clean-up operation in California following the Santa Barbara oil spill.

4. This Order comes into force on the tenth day after the publication thereof in *The Ontario Gazette* under *The Regulations Act.*

We Concur:

Advisory Committee for
the Barbering Industry
Renfrew zone:

W. STRINGER,
Chairman.
PHILIP BOLGER

WILFRED MOORE

DENIS WATTS

PATRICK VECCHIO

M. E. HOWARD,
Director of Labour Standards.

Dated at Toronto, this 22nd day of April, 1968.

(819) 50

THE INDUSTRIAL STANDARDS ACT

O. Reg. 419/68.
Schedule—Plumbing and Heating
Industry—Toronto Zone.
Made—November 28th, 1968.
Filed—December 4th, 1968.

REGULATION MADE UNDER THE INDUSTRIAL STANDARDS ACT

1. The Schedule is in force during pleasure within the Toronto zone and is binding upon the employers and employees in the plumbing and heating industry.

2. This Regulation comes into force on the tenth day after the publication thereof in *The Ontario Gazette* under *The Regulations Act.*

Schedule

PLUMBING AND HEATING INDUSTRY

TORONTO ZONE

INTERPRETATION

1. In this Schedule, "holiday" means,

(i) Sunday;

(ii) New Year's Day;

(iii) Good Friday;

(iv) Labour Day;

(v) Thanksgiving Day; and

(vi) Christmas Day.

HOURS OF WORK

2. The regular working period for the industry is a regular working week consisting of not more than forty-five hours of work performed on Monday, Tuesday, Wednesday, Thursday, Friday and Saturday.

MINIMUM RATE OF WAGES

3. The minimum rate of wages for work performed during a regular working period is $4 an hour.

OVERTIME WORK

4. Overtime work is work,

(*a*) that is not performed during a regular working period; or

(*b*) that is performed on a holiday.

RATE OF WAGES FOR OVERTIME WORK

5. The rate of wages for overtime work is $6 an hour.

RATE FOR HANDICAPPED

6. The Advisory Committee is authorized to fix a minimum rate of wages lower than the rate fixed by this Schedule for an individual who is handicapped.

APPLICATION

7. This Schedule applies to all operations in the industry performed in work on new construction only.

8. This Schedule does not apply to work performed by persons in the course of their employment as employees of The Hydro-Electric Power Commission of Ontario or a municipal corporation or public utility commission producing or distributing electric power.

DALTON BALES,
Minister of Labour.

Dated at Toronto, this 26th day of November, 1968.

(831) 50

THE ENERGY ACT, 1964

O. Reg. 420/68.
Exploration, Drilling and
Production.
Made—December 5th, 1968.
Filed—December 6th, 1968.

REGULATION MADE UNDER THE ENERGY ACT, 1964

EXPLORATION, DRILLING AND PRODUCTION

INTERPRETATION

1. In this Regulation,

(*a*) "battery" means storage facilities receiving production from a well or wells;

(*b*) "completion date" means the date on which the total depth of a well is reached;

(*c*) "development well" means a well that is bored, drilled or deepened for the purpose of producing from or extending a pool of oil or gas into which another well has already been bored or drilled;

(*d*) "exploratory well" means a well that is bored, drilled or deepened for the purpose of discovering a pool of oil or gas;

(*e*) "operator",

(i) when used in respect of any operations carried on for the purpose of drilling or plugging a well, means a person who has the right as lessee, sub-lessee, assignee, or owner to carry on the drilling or plugging operations, and the person who has the control or management of such operations, and

(ii) when used in respect of a well, means a person who has the right as lessee, sub-lessee, assignee or owner to the production from the well, and the person who has the control and management thereof, provided that such person either drilled or produced the well;

(*f*) "pool" means an underground accumulation of oil or gas or both, separated or appearing to be separated from any other such accumulation;

(*g*) "pooled spacing unit" means a spacing unit in which all the various interests have been pooled;

(*h*) "pooling" means the joining or combining of all the various interests within a spacing unit for the purpose of drilling and subsequent producing of a well;

(*i*) "spacing unit" means, as the context requires, either,

(i) the surface area allocated to a well for the purpose of drilling for, or the production of, oil or gas, or

(ii) the subsurface regions vertically beneath such area,

and a spacing unit may be designated through the description of a surface area;

(*j*) "target area" means the area within a spacing unit that is allocated for drilling a well;

(*k*) "tract",

(i) in the case of a standard 200 acre lot means a unit of area obtained by the division of the lot into eight equal rectangular areas each being 25 acres more or less and each tract within the lot shall be described by number in the manner set forth in Schedule 3, and

(ii) in the case where the lot is not a standard 200 acre lot means a unit of area obtained by the division of the lot into such equal rectangular areas, as may be approved by the Minister;

(*l*) "waste", in addition to its meaning as ordinarily understood in the oil and gas industry, includes,

(i) the inefficient, excessive, or improper use or dissipation of reservoir energy,

(ii) the locating, spacing, drilling, equipping, operating or producing of any well or wells in a manner that causes, or might cause, a reduction in the quantity of oil or gas ultimately and economically recoverable from any pool,

(iii) the inefficient storing of oil or gas, whether on the surface or underground, and

(iv) the locating, spacing, drilling, equipping, operating or producing of any well or wells in a manner that causes, or might cause unnecessary or excessive surface loss or destruction of oil or gas;

(*m*) "water-covered area" means any area covered by flowing or standing water.

LICENSING

2.—(1) A licence to conduct geophysical or geochemical exploration for oil or gas shall be in Form 101 and the fee therefor is $10.

(2) A licence to conduct geophysical or geochemical exploration for oil or gas shall be applied for by and issued to the person on whose behalf the exploration is being conducted.

(3) A licence in Form 101 expires with the 31st day of December of the year for which it is issued and is not transferable.

3.—(1) A licence to lease oil or gas rights from an owner other than the Crown shall be in Form 102 and the fee therefor is $10.

(2) A licence in Form 102 expires with the 31st day of December of the year for which it was issued and is not transferable.

(3) A licence in Form 102 is issued subject to the condition that where the licencee leases oil or gas rights on behalf of another, the person on whose behalf he is leasing is also the holder of a licence in Form 102.

4.—(1) A licence for a machine for boring, drilling, deepening or plugging wells shall be in Form 103 and the fee therefor is $10.

(2) A licence in Form 103 expires with the 31st day of December of the year for which it is issued.

(3) Where a transfer in ownership of a machine is effected, the Minister shall be notified within thirty days of such transfer.

(4) A licence in Form 103 shall be kept at the machine and be available for inspection.

(5) The owner of a machine shall comply with the drilling safety code in Schedule 1.

5.—(1) A licence to produce oil or gas for sale shall be in Form 104 and the fee therefor is $10.

(2) A licence in Form 104 expires with the 31st day of December of the year for which it is issued and is not transferable.

6. A licence under sections 2, 3, 4 or 5 is issued on the condition that the holder thereof complies with the Act, the regulations and any order of the Board.

IDENTIFICATION OF WELLS AND BATTERIES

7. The operator of every well or battery shall mark it with a prominent sign located in a conspicuous place showing the name of the operator and the name of the well or battery and shall maintain such sign until the well is plugged or the battery dismantled.

8. The length of a well name shall not exceed thirty-three characters and spaces, and such name shall not be changed without approval by the Minister.

RESTRICTED DRILLING AREAS

9. No person shall bore or drill a well,

(*a*) within 150 feet of any high voltage power line, road allowance, railway, transmission pipeline or other utility right of way;

(*b*) within 250 feet of any dwelling, commercial or industrial building, school, church or place of public assembly;

(*c*) on land, within 350 feet of the shoreline; or

(*d*) in water-covered areas, within one-half mile of the shoreline or within one-half mile of the International Boundary,

except where special circumstances exist that in the opinion of the Minister justify the drilling of a well within a lesser distance of any of the above-mentioned limits and a permit to do so has been granted.

Spacing

EXPLORATORY WELLS

10.—(1) Where an exploratory well is bored or drilled into and not below a formation of Devonian age, the well shall be on a pooled spacing unit of not less than 6¼ acres and shall be located not closer than 200 feet to any boundary of the pooled spacing unit.

(2) Where an exploratory well is bored or drilled into and not below a formation of Silurian age, the well shall be on a pooled spacing unit of not less than 25 acres and shall be located not closer than 350 feet to any boundary of the pooled spacing unit.

(3) Where an exploratory well is bored or drilled into or below a formation of Ordovician age, the well shall be on a pooled spacing unit of not less than 50 acres and shall be located not closer than 350 feet to any boundary of the pooled spacing unit.

(4) An exploratory well shall be bored or drilled in the target area of a tract or quarter tract but the Minister may approve a deviation from the target area of a tract or quarter tract where conditions require such deviation.

(5) The Minister may issue a permit to bore, drill or deepen an exploratory well that does not comply with this section subject to the condition that there is no production from the well until a pooled spacing unit that complies with this section has been established.

11. Where an exploratory well is bored or drilled in a water-covered area, the well shall be located not closer than 1320 feet to the boundary of the area described in the licence of occupation.

12.—(1) Where an operator discovers a pool capable of producing oil or gas, any person having oil or gas rights in respect of the pool may apply to the Minister for the establishment of spacing units and, where no other person has applied within ninety days of the discovery, the person who discovered the pool shall apply, unless otherwise instructed by the Minister.

(2) An application shall be accompanied by a plan of the lands comprising the probable area of the pool, certified by an Ontario Land Surveyor or Professional Engineer qualified to practise in Ontario or other person acceptable to the Minister, showing,

(*a*) where the well is on land, the location of the well in relation to the boundaries of the lands, roadways and topographical features of the area;

(*b*) where the well is in a water-covered area, the location of the well in relation to the shore, the International Boundary and the boundaries of licenses of occupation and leases;

(*c*) the names of all persons having oil and gas rights in respect of the pool; and

(*d*) a description of the interests of such persons.

(3) The applicant shall serve a true copy of the application and plan upon the persons mentioned in clause *c* of subsection 2 within five days of the making of the application.

(4) Except where the Minister has otherwise instructed, no person shall bore or drill a development well into a pool referred to in subsection 1 until the application has been made and disposed of.

DEVELOPMENT WELLS

13.—(1) This section applies only where a development well is bored or drilled into a pool in respect of which a regulation establishing spacing units has not been made.

(2) Where a development well is bored or drilled into and not below a formation of Devonian age, the well shall be on a pooled spacing unit of not less than 6¼ acres and shall be located not closer than 200 feet to any boundary of the pooled spacing unit.

(3) Where a development well is bored or drilled into or below a formation of Silurian age, the well shall be on a pooled spacing unit of not less than 25 acres and shall be located not closer than 350 feet to any boundary of the pooled spacing unit.

OTHER WELLS

14. Where a well is not classified as an exploratory well or a development well and is drilled,

(*a*) for the storage of hydrocarbons;

(*b*) for the secondary recovery of oil;

(*c*) for the testing of subsurface structures;

(*d*) for the injection of fluid;

(*e*) for the disposal of waste or mineral waters; or

(*f*) for observation,

the location of the well shall be subject to approval by the Minister.

BONDING

15.—(1) Subject to subsection 2, a permit to bore, drill or deepen a well shall not be issued to a lessee unless the applicant has deposited in respect of the well with the Treasurer of Ontario,

(*a*) cash or direct or guaranteed securities of the Government of Canada or of the Government of Ontario; or

(*b*) where the Minister consents thereto, a bond of a guarantee company approved under *The Guarantee Company Securities Act* in a form satisfactory to the Minister,

in the amount of $500, or where the well is in a water-covered area $20,000, as security for the completion of the works in accordance with the Act, the regulations and any order of the Board.

(2) The total amount deposited by a person under subsection 1 shall not exceed $5,000 in respect of wells on land or $200,000 in respect of wells in water-covered areas.

(3) The Treasurer of Ontario shall return the security deposited in respect of a well,

(*a*) if the amount returned does not reduce the total security deposited by the person in respect of other wells to less than the amount determined under subsections 1 and 2; and (*b*) the Minister certifies that the well is plugged in accordance with the Act, the regulations and any order of the Board; or

(*c*) the well is sold by the lessee to the owner of the land on which the well is situate.

(4) Where the Minister takes possession of a well under section 41, there is forfeited and shall be paid to the Treasurer of Ontario the sum of $500 where the well is on land or $20,000 where the well is in a water-covered area, out of the total security deposited by the person to whom the permit to bore, drill or deepen the well is issued.

(5) A bond deposited under clause *b* of subsection 1 may be cancelled by any person bound thereunder by giving to the Minister at least three months' notice in writing of intention to cancel and it shall be deemed to be cancelled on the date stated in the notice, which date shall be not less than three months after the receipt of the notice by the Minister.

(6) Where a bond is cancelled under subsection 5, for the purpose of every act or omission occurring with respect to the well to which the bond is referable and prior to the cancellation, the bond shall continue in force for a period of two years after the cancellation.

(7) Where there has been a forfeiture under subsection 4, or a cancellation under subsection 5, every permit to bore, drill or deepen a well and every licence to produce oil or gas held by the person who deposited the security forfeited or cancelled is suspended until the total amount of the security required by subsections 1 and 2 is restored.

(8) The Treasurer of Ontario may sell any securities deposited and forfeited under this section at the current market price.

(9) Where the owner of the land on which a well drilled after the 30th day of August, 1962 is situate, sells the well or leases the oil or gas rights, the purchaser or lessee shall deposit in respect of the well security in the amount prescribed by this section.

DRILLING AND COMPLETION

16.—(1) An application for a permit to bore, drill or deepen a well shall be made in duplicate in Form 105.

(2) Where the application is in respect of a well on land it shall be accompanied by a scaled plan certified by an Ontario Land Surveyor or Professional Engineer qualified to practise in Ontario or other person acceptable to the Minister showing,

(*a*) exact co-ordinates of the well from two intersecting sides of the lot;

(*b*) the elevation above sea level of the well site including the datum from which it is derived;

(*c*) where the spacing unit is within a township lot, the position of the spacing unit within the lot; and

(*d*) such further information as the Minister may require.

(3) The holder of the permit shall forthwith notify the inspector in writing of any change in the information supplied on Form 105 or the accompanying scaled plan and shall not commence drilling unless the inspector approves such changes.

(4) A permit to bore, drill or deepen a well shall be in Form 106 and the fee therefor is $15 and the permit is not transferable.

17.—(1) The operator shall notify the inspector before commencing drilling, boring or deepening operations and such notice shall be given in the forty-eight hour period preceding commencement.

(2) When a well is in the process of being bored, drilled, deepened, worked over or plugged, the operator shall keep at the well or at his field office, provided it is within reasonable distance of the well, a daily record of the operations.

(3) The daily record shall set out complete information on all operations carried on during the day and, without restricting the generality of the foregoing, shall include,

(*a*) the depth at the beginning of the day or shift;

(*b*) the depth at the end of the day or shift;

(*c*) the diameter of the hole;

(*d*) any change in casing;

(*e*) if casing is set, all information regarding the setting including size, type, grade and weight of casing, whether the casing is new or used, and the depth at which it is set;

(*f*) particulars of cementing;

(*g*) the depth at which any showing, however small, of oil, gas or water is encountered, and the flows, pressures and levels thereof; and

(*h*) a report of each log, survey, formation test, deviation test or other test taken or made.

(4) Any suspension of operations shall be noted on the daily record.

(5) The record kept shall note and describe, in addition to drilling operations, all other operations carried on, including fishing, shooting, perforating, acidizing, fracturing, surveying and plugging.

(6) The record required by this section shall be available to the Department at all reasonable times.

18. Before commencing to bore, drill or deepen a well, a proper and adequate slush pit or pits shall be constructed for the reception of all drill cuttings and fluids from the well.

19. The operator shall ensure that all casing, tubing and equipment used in the drilling of a well is in good condition and adequate for the depths to be drilled and the pressures that may be encountered.

20.—(1) The operator of a well shall plan and effect a casing and cementing programme for the well to protect all fresh water horizons and all potential oil-bearing or gas-bearing horizons penetrated during drilling operations and to prevent the migration of oil, gas or water from one horizon to another.

(2) The operator of a well drilled with rotary equipment shall run sufficient surface casing to protect all fresh water horizons and such surface casing shall be cemented to surface by displacement or pump with adequate time allowed for the cement to set.

21.—(1) The operator of a well shall ensure that all fluid produced or recovered from a well during drilling operations is disposed of in a manner that will not interfere with the rights of any person.

(2) The operator of a well shall ensure that salt water, drilling fluid, oil, refuse and any flammable products from a well are not handled or disposed of so as to,

(*a*) create or constitute a hazard to public health or safety;

(*b*) run into or contaminate any fresh water horizon or body of water or remain in a place from which it might contaminate any fresh water or body of water; or

(*c*) run over or damage any land, road, building or structure.

22.—(1) The operator of a well shall take every precaution to ensure that a well does not flow uncontrolled.

(2) The operator shall report to the Department immediately any well flowing uncontrolled.

23. The operator of a producing well shall ensure that,

(*a*) strings of casing intermediate between the producing casing and the surface casing are not recovered unless all horizons containing oil, gas or mineral water are cemented off to the satisfaction of the inspector; and

(*b*) the surface casing is not recovered.

24. At the end of every drilling or plugging operation or as soon as weather and ground conditions permit, the operator shall,

(*a*) clear the area around the well of all refuse material;

(*b*) burn or remove waste petroleum;

(*c*) drain and fill in excavations;

(*d*) where the pits contain salt or other chemicals which may inhibit plant growth, clean out such pits before filling;

(*e*) remove concrete bases, machinery and materials; and

(*f*) level the surface to leave the site as nearly as is reasonably possible in the condition in which it was when drilling operations were commenced.

WELL BLOWOUT PREVENTION

25.—(1) The operator of a well being bored, drilled, deepened, tested, completed, stimulated or worked over shall provide and maintain casing and blowout prevention equipment in such condition that any oil, gas or water encountered can be effectively controlled.

(2) The operator shall ensure that blowout prevention equipment is adequate, having regard to the depth to be drilled, the expected pressure and the necessity in case of blowout of obtaining a shutoff of the open hole or around any equipment being employed in the well.

(3) The blowout prevention equipment shall include two steel lines, separately connected to the blowout preventer assembly, one for bleeding off pressures and one for killing the well, and shall be,

(*a*) located below at least one set of blowout preventers;

(*b*) of a diameter of at least two inches; and

(*c*) of components and material having a working pressure equal to that of the blowout preventers.

(4) The operator shall locate all manual controls for mechanically operated blowout preventers at least 2 feet outside the substructure and, when such blowout preventers are used at a well which is being tested, completed or worked over, the controls shall be at least 10 feet from the well.

(5) While a well is being drilled, the operator shall test blowout prevention equipment daily and record the results of such tests in the daily record.

(6) Where an inspector considers that the casing or blowout prevention equipment at a well is not adequate, he may tag the well.

WATER-COVERED AREAS

26.—(1) In this section, "well" means a well in a watered-covered area.

(2) An applicant for a permit to bore, drill or deepen a well shall furnish proof to the satisfaction of the Minister that he has subsisting liability insurance of at least $1,000,000 that provides compensation for all damage caused by the drilling operations.

(3) An applicant for a licence to produce oil or gas from a well shall furnish proof to the satisfaction of the Minister that he has subsisting liability insurance of at least $1,000,000 that provides compensation for all damage caused by the production operations.

(4) A licence for a machine for boring, drilling, deepening or plugging a well is issued on the condition that the machine is not used to bore, drill, deepen or plug a well unless the operator furnishes proof to the satisfaction of the Minister that he has subsisting liability insurance of at least $1,000,000 that provides compensation for all damage caused by the machine, or by any vessel, craft or barge used to transport men or materials to the machine.

(5) Prior to applying for a permit to bore, drill or deepen a well, the operator shall submit, in duplicate, to the Minister, plans and specifications of the proposed wellhead assembly.

(6) The well location shall be verified by survey, with the drilling rig on location and a copy of this survey shall accompany Form 107.

(7) When an operator has encountered oil in a well or is boring, drilling or deepening a well in an area where oil may reasonably be expected to be encountered, he shall, in addition to the requirements of the other provisions of this Regulation, provide in operating condition oil-saving equipment, discharge equipment and emergency oil storage.

(8) The operator of a well shall ensure that the production casing is cemented to surface before production commences.

(9) The operator of a producing well shall ensure that,

(*a*) the wellhead is encased below the bed of the body of water; or

(*b*) the over-all height of the wellhead assembly above the bed of the body of water is kept to a minimum, but shall not exceed 5 feet.

(10) Where the area in which the well is located is designated by the Minister as a primary trawling area, the wellhead shall be fitted with a trawl deflector of a design approved by the Minister.

(11) Where the area in which the well is located is designated by the Minister for other types of commercial fishing, the wellhead shall be fitted with a protective device of a design approved by the Minister.

(12) At the end of every drilling or plugging operation, the operator of the well shall ensure that any platform, piling, anchor-post or other obstruction is removed as soon as is reasonably possible, and in any case within thirty days, but a permanent platform of a design approved by the Minister may be installed for the production of oil or gas.

(13) The operator shall mark each wellhead with a buoy marker of a design approved by the Minister and shall maintain such marker.

(14) Each marker shall be identified as to company name and well name.

(15) No person shall remove or damage a marker erected under subsection 13, other than the operator who is required to maintain the marker.

(16) When a well is plugged, the operator shall cut off any casing left in the well at or below the bed of the body of water.

DEVIATION AND DIRECTIONAL SURVEYS

27.—(1) In the case of a rotary drilled well, the operator of a well shall, where so directed by the Minister, make or cause to be made, deviation tests during drilling at intervals not exceeding 500 feet from the top to the bottom of the well, for the purpose of ascertaining deviation from the vertical, and when the Minister so requires shall make, or cause to be made, a directional survey of the well.

(2) Where the operator of a well fails to make a deviation test or survey required by subsection 1, the Minister may order that,

(*a*) no further drilling be conducted at the well; or

(*b*) where the well has been placed on production, no further production be taken,

until the test or survey is made.

(3) Immediately upon making a directional survey of a rotary drilled well, the operator shall make a report in writing to the Minister setting out the manner in which the survey was made and the results thereof.

(4) The Minister may order the operator of a well to make such further tests or surveys as he deems necessary, and may give directions as to the manner in which such tests or surveys shall be made.

PRODUCTION

28. Before production from a well commences, the operator shall arrange the surface equipment so as to permit,

(*a*) the measurement of the tubing or casing pressure;

(*b*) the measurement of the open flow; and

(*c*) the sampling of oil, gas and water.

29.—(1) The operator of a producing oil or gas well shall keep at an office within Ontario, in a form satisfactory to the Minister, complete and accurate records of the well showing,

(*a*) the quantities of oil, gas, any product of oil or gas, water and sediment produced;

(*b*) the average separator pressure if a separator is in use;

(*c*) full particulars of the disposition of all products of the well; and

(*d*) where the product is sold, the name of the purchaser and amount realized from the sale,

but, where group production has been approved by the Minister, such records shall be kept for the group of wells and all records shall be available for examination at all reasonable times by the Minister or his representative.

(2) An operator referred to in subsection 1 may be required to file with the Minister any or all reports required under that subsection.

(3) The operator of a producing oil or gas well shall measure the production of oil, gas and water from the well in accordance with standard field practices, but the Minister may permit him to commingle such production with production from another well or wells prior to measurement.

30. The operator of a well shall use every possible precaution to prevent waste of oil or gas in production operations and in storing or piping oil or gas, and shall not use oil or gas wastefully or allow it to leak or escape from natural reservoirs, wells, tanks, containers or pipes.

31.—(1) The operator of a well shall ensure that all water produced from a well is disposed of in a manner that will not interfere with the rights of any person.

(2) The operator of a well shall ensure that salt water, oil, refuse and any flammable products from a well, tank or other production installation are not handled or disposed of so as to,

(*a*) create or constitute a hazard to public health or safety;

(*b*) run into or contaminate any fresh water horizon or body of water or remain in a place from which it might contaminate any fresh water or body of water; or

(*c*) run over or damage any land, road, building or structure.

(3) The operator of a well shall ensure that all rubbish, debris and oily refuse from a well or tank or resulting from any operation at a well is,

(*a*) removed immediately at least 150 feet from buildings, tanks, wells, pump stations or other sources of ignitable vapours; and

(*b*) immediately thereafter burned or disposed of in such other manner that no fire hazard is created and no fresh water is polluted.

32. Where a brine-storage tank is installed at a well site or battery site, it shall be above ground level, and be provided with a dike having a volume capacity 25 per cent greater than the capacity of the tank.

33. The operator of a well shall ensure that,

(*a*) oil is not stored in open excavations or open containers, or otherwise stored so as to create a hazard;

(*b*) oil tanks or batteries of tanks are surrounded by a dike having a volume capacity 25 per cent greater than the capacity of the tanks or batteries and kept free of high grass, weeds and combustible material;

(*c*) all wellheads, gathering lines, battery equipment and services are designed, constructed, installed, operated and maintained in accordance with sound engineering practice, and so as to prevent hazards to surrounding property;

(*d*) oil storage tanks are located at least 50 feet from any high voltage power line, road allowance, railway, transmission pipe line or other utility right of way and at least 250 feet from any dwelling, commercial or industrial building, school, church or place of public assembly;

(*e*) any significant volume of gas vented to the atmosphere during production is flared;

(*f*) all flare pits and ends of flare lines are so constructed and safeguarded that there is no hazard to property, crops or trees and are located at least 75 feet from any high voltage power line, road allowance, railway, transmission pipe line or other utility right of way and at least 150 feet from any dwelling, commercial or industrial building, school, church or place of public assembly; and

(*g*) except with the consent of the landowner, all flow lines and gathering lines located outside well sites and battery sites are buried below plough depth.

34. The operator of a well shall ensure that,

(*a*) all fires used by him for any purpose are safeguarded by sufficient mechanical or other means so as to create no hazard to surrounding property;

(*b*) no open-element electric heater or flame-type stove heater, treater or other flame-type equipment is placed or remains within 50 feet of a well or any unprotected source of ignitable vapour;

(*c*) no treater is placed or remains within 50 feet of any type of direct-fired heater;

(*d*) no treater is placed or remains within 10 feet of any other treater, or indirect-fired heater;

(*e*) no separator is located within the dike surrounding a storage tank installation;

(*f*) no flare pit or open end of a flare line is located or remains nearer to a treater than 50 feet or nearer to a well or any unprotected source of ignitable vapour than 100 feet;

(*g*) all vessels and equipment from which ignitable vapours may issue are safely vented to the atmosphere;

(*h*) no person enters any tank or other container used for the storage of oil or any product of oil unless all fumes have been removed or the person is wearing a mask and is attended by two other persons;

(*i*) all electric motors within 25 feet of a well or any unprotected source of ignitable vapour are so constructed or enclosed as to be gas-tight and spark-proof;

(*j*) the exhaust pipes of internal combustion engines located within 50 feet of a well or any unprotected source of ignitable vapour are either insulated or sufficiently cooled to prevent ignition of flammable material;

(*k*) the exhaust pipes of internal combustion engines located within 25 feet of a well are equipped with a spark arrester and are either insulated or sufficiently cooled to prevent ignition of flammable material; and

(*l*) explosives are stored not less than 500 feet from any place where production is being carried on.

WELL TESTS

35.—(1) This section does not apply to gas storage wells.

(2) The operator of an oil producing well shall give the Minister reasonable notice of any downhole test or gas-oil ratio test to be taken at the well, and each test may be witnessed or observed by the Minister or his representative.

(3) The operator of a gas producing well shall give the Minister reasonable notice of any downhole test or back-pressure test to be taken at the well, and each test may be witnessed or observed by the Minister or his representative.

(4) Shut-in pressures on each gas producing well shall,

(*a*) where the well is on land, unless exempted by the Minister, be taken by the operator annually and be reported to the Minister on Form 109; or

(*b*) where the well is in a water-covered area and where the Minister so requires, be taken by the operator annually and be reported to the Minister on Form 109; and

(*c*) be taken with a dead-weight gauge or other equipment approved by the Minister, after the shut-in time required to reach stabilization or twenty-four hours, whichever is the lesser.

(5) The operator of a gas producing well shall, where the Minister so requires, determine the open-flow potential of the well and report to the Minister.

DISPOSAL

36.—(1) No person shall dispose of waste or mineral water in an underground formation without the approval of the Minister.

(2) Wells for the disposal of waste or mineral water shall be cased and cemented in such a manner as to prevent the waste or mineral water from entering any formation not approved for the purpose under subsection 1.

PLUGGING

37.—(1) The operator of a dry well shall plug the well in a manner prescribed by this Regulation forthwith after drilling operations cease.

(2) Where, in the opinion of the Minister, the operations in respect of a well have been discontinued or delayed for an unreasonable period of time, he may, by notice in writing to the operator, require that the well be plugged within thirty days after the notice is sent.

(3) If within thirty days after the notice is sent, the well is not plugged or the operator fails to show cause to the satisfaction of the Minister for not plugging the well, the Minister may take possession of the work.

(4) The Minister may extend the time for plugging any well upon such terms and conditions as he deems advisable.

38. The last operator of a well shall plug or replug the well in accordance with this Regulation.

39.—(1) Every person who plugs a well shall do so in a manner that,

(*a*) ensures protection for potential oil or gas producing horizons;

(*b*) prevents the migration of oil, gas or water from one horizon to another;

(*c*) constitutes no hazard to users of the surface; and

(*d*) seals off horizons from those above and below.

(2) Without restricting the requirements of subsection 1, a well shall be plugged in the manner specified in Schedule 2.

40. No person shall commence to plug a well until he has given notice to the inspector of the manner in which the plugging is to be carried out.

41.—(1) Where a work is not in compliance with the Act, the regulations or any order of the Board and if after notice thereof is given to the operator or, where the name and address of the operator is not known to the Minister, is given to the owner of the lands on which the work is situate, the non-compliance is not corrected in the time specified in the notice, the Minister may take possession of the work and may,

(*a*) cause such things to be done as are necessary to make the work conform to the Act, the regulations and any order of the Board; or

(*b*) remove and sell the work or any part of it.

(2) The Minister may recover from the operator of the work,

(*a*) the expenses incurred in any action taken under subsection 1, where there is no sale; or

(*b*) the excess of the expenses over the net proceeds of the sale, where there is a sale.

42. No person shall be liable to the Minister for the expenses incurred under section 41 until notice has been given and there has been default in complying with the notice.

REPORTS

43. The holder of a licence in Form 101 shall make a report to the Minister on or before the 15th day of February in each year setting out in respect of the previous licence year,

(*a*) the exploration methods used;

(*b*) the number of crew-months worked;

(*c*) the number of acres or linear miles explored in each municipality;

(*d*) the name of any person with whom the licencee has contracted to conduct geophysical or geochemical exploration for oil or gas on behalf of the licencee; and

(*e*) a map of the area explored showing the locations where data were observed and recorded.

44. The holder of a licence in Form 102 or his employer shall make a report to the Minister on or before the 15th day of February in each year, setting out in respect of the previous licence year, the total acreage leased in each municipality.

45. Every operator shall, within thirty days after the end of boring, drilling or deepening operations, forward or deliver to the Department at the operator's expense,

(*a*) samples of drill cuttings taken throughout the depth of the well from each run, or from intervals of not more than 10 feet, and such samples shall be washed, dried and bagged in a bag provided by the Minister and accurately labelled by the operator with the name of the well and the depth interval;

(*b*) representative core chips but from intervals of not more than 2 feet, and such chips shall be washed, dried and bagged in a bag provided by the Minister and accurately labelled by the operator with the name of the well and the depth interval;

(*c*) a complete record in duplicate in Form 107;

(*d*) in the case of exploratory wells, samples of not less than one gallon of oil and two quarts of water recovered from below the top of the Trenton formation; and

(*e*) at the request of the Minister, samples of any oil, gas or water recovered from any well.

46.—(1) The operator shall supply to the Minister within thirty days after the end of boring, drilling or deepening operations,

(*a*) a copy of all drill-stem test reports and of the pressure charts for each drill-stem test taken at the well; and

(*b*) a list of the drill-stem tests taken at the well indicating the chronological sequence and depth interval of each drill-stem test.

(2) During any period of testing following completion of a well or following working over of a well, the operator shall maintain a record of the production which shall be available to the Department.

(3) Where an operator has completed a gas well with an estimated open flow in excess of one million cubic feet per day, the operator shall determine the deliverability of the well according to recognized standards of back-pressure testing and shall report the observed field data to the Minister.

47. Where any log or survey is taken in a well, two copies of the log or survey shall be supplied to the Minister by the operator within thirty days after the log or survey has been made.

48. Where a well is worked over, stimulated, plugged-back or re-cased, the operator shall make a report to the Minister within thirty days in Form 107.

49. When an operator has caused a core analysis or any other test or analysis to be made, he shall submit a copy thereof to the Minister within thirty days.

50.—(1) Where cores are taken, the operator shall pack them in numbered boxes, accurately labelled showing the name of the well and the depth interval, and the boxes shall be protected from damage and stored by the operator.

(2) No core shall be destroyed, except for the purpose of analysis.

(3) Where cores are no longer required by the operator for the purpose of analysis, the Minister may instruct the operator to forward them to the Department.

(4) No person shall remove a core from Ontario without the written approval of the Minister.

51. The operator of a well shall, upon the request of the Minister, determine the measurement of oil, gas and water produced by the well and report the determination to the Minister.

52.—(1) Every producer of oil for sale shall, on or before the 15th day of February in each year, make a report in triplicate to the Minister in Form 108, in respect of the preceding licence year.

(2) Every producer of gas for sale shall, on or before the 15th day of February in each year, make a report in triplicate to the Minister in Form 109, in respect of the preceding licence year.

(3) Every producer of oil or gas shall maintain a map or maps of his production and collection systems, and such map or maps shall be available for examination at all reasonable times by the Minister or his representative.

53.—(1) The operator of an injection well used to repressure, maintain pressure in or flood any oil or gas horizon shall keep at the well, or at his field office, a record in a form satisfactory to the Minister showing,

(*a*) the volume of fluid or other substance injected into the well;

(*b*) the source from which the fluid or other substance was obtained;

(*c*) the average injection rate;

(*d*) the average injection pressure; and

(*e*) particulars of any treatment to which the fluid or other substance has been subjected.

(2) An annual summary of the data required in subsection 1 shall be forwarded to the Minister on or before the 15th day of February in each year in respect of the preceding year.

54.—(1) The operator of a well for the disposal of waste or mineral water shall keep at the well, or at his field office, a record in a form satisfactory to the Minister showing,

(*a*) the volume of fluid injected into the well;

(*b*) the source from which the fluid was obtained;

(*c*) the average chemical composition of the fluid;

(*d*) the average injection rate; and

(*e*) the average injection pressure.

(2) An annual summary of the data required in subsection 1 shall be forwarded to the Minister on or before the 15th day of February in each year in respect of the preceding year.

55. Where a well is plugged, the operator or person who plugs the well shall make a report to the Minister within thirty days in Form 110.

RELEASE OF INFORMATION

56.—(1) Except where the operator consents in writing to release at an earlier date, information obtained from an operator and recorded with the Department shall not be released except in accordance with the provisions of subsections 2, 3, 4, 5, 6 and 7.

(2) The following information shall not be released:

1. All operators' pool studies and reserve estimates, unless filed at a public hearing or inquiry.
2. Crown Reserve estimates.
3. All information submitted to the Department not required by regulation, obtained at extra expense to the operator and requested to be held confidential.

(3) Where a well is classified by the Department as an exploratory well, the following information respecting it shall be held confidential for one year from its completion date:

1. Connate water determinations and other liquid saturation measurements.
2. Drill-stem test data.
3. Core analyses.
4. Oil, gas and water, and pressure-volume-temperature analyses.
5. Static top hole or bottom hole pressure data.
6. Flowing and other special bottom hole pressure data gathered by the Department.
7. Back pressure test data.
8. Perforations, well treatments, cored intervals and abandonment details.
9. Logs, except those logs which, in the opinion of the Minister, are obtained solely for geophysical purposes.
10. Geological markers.
11. Drill cutting samples and core and information from drill cutting samples and core preserved by the Department.

(4) Where a well is classified by the Department as a development well, the following information respecting it shall be held confidential for at least thirty days from the completion date of the well and in any event not be released prior to the release of information respecting the discovery well:

1. Connate water determinations and other liquid saturation measurements.
2. Drill-stem test data.
3. Core analyses.
4. Oil, gas and water and pressure-volume-temperature analyses.
5. Static top hole or bottom hole pressure data.
6. Flowing and other special bottom hole pressure data gathered by the Department.
7. Back pressure test data.
8. Perforations, well treatments, cored intervals and abandonment details.
9. Logs, except those logs, which in the opinion of the Minister, are obtained solely for geophysical purposes.
10. Geological markers.
11. Drill cutting samples and core and information from drill cutting samples and core preserved by the Department.

(5) The following information shall be held confidential for one year from the date of receipt by the Department:

1. Daily production rates.
2. Secondary recovery data for individual wells or systems.
3. Annual geophysical and geochemical reports as required by section 43.
4. Annual leasing reports as required by section 44.

(6) The following information shall not be held confidential:

1. Applications and submissions presented at a public hearing.

2. Monthly and annual production data.

3. Waste or mineral water disposal data for individual wells or systems.

4. Storage data for gas or liquefied petroleum gases.

(7) Logs that, in the opinion of the Minister, are obtained solely for geophysical purposes shall be held confidential for twenty-four months from the date of logging.

REPORT OF ACCIDENT

57. The operator shall report to an inspector immediately and shall report further by letter, any fire or explosion or any accident causing personal injury requiring medical treatment that occurs at a drilling rig, oil or gas well, production line, field battery installation, field storage tank or other work owned, operated or controlled by the operator.

OFFENCES

58.—(1) A tag attached to a work under section 3 of the Act shall be in Form 601.

(2) The permission of the Minister to lay an information under section 9 of the Act shall be in Form 602.

59.—(1) A person who is required under this Regulation to file a record, return or report and fails to do so shall, upon the written demand of the Minister, file the record, return or report within such reasonable time as the Minister stipulates.

(2) A demand under subsection 1 shall be deemed to be made if mailed by registered mail addressed to the last known address of the person upon whom it is being made.

REVOCATION

60. Ontario Regulations 326/64, 372/66, 154/68 and 244/68 are revoked.

Schedule 1

DRILLING SAFETY CODE

1. Every owner of a machine for boring, drilling, deepening or plugging wells shall take all necessary measures to enforce this Schedule and to ensure that it is observed by every employee under his control.

2. Every employee of the owner shall take all measures to carry out his duties in accordance with such rules as are applicable to the work in which he is engaged.

3. No machine, tool or other equipment shall be used if it is unsafe, or not so constructed or operated that it is reasonably safe for persons employed on or around a machine for boring, drilling, deepening or plugging wells.

4. Spudding or drilling shall not be commenced until all moving parts of machinery used in the spudding or drilling are guarded and until all necessary floors, stairways and handrails are installed.

5. Every floor, walk, ladder or platform shall be constructed of sound material in conformance with good practice, and shall be kept in good repair.

6. Every drilling floor shall have an exit on at least two sides, and doors on the exits shall open outwards and shall be kept unlocked when any person is on the drilling floor.

7. Doghouses shall have a second exit on the side away from the drilling floor, which shall open outwards and be unlocked when any person is on the drilling floor.

8. All platforms used in connection with rotary machines shall be adequately constructed and properly fastened and provided with safety railings at least three feet high.

9. A safety belt shall be provided for and worn by each person working above the derrick floor, and shall be kept in good repair and shall be securely fastened to the derrick or mast.

10. Hard hats shall be worn by all persons on or around the machine during erection, operation, maintenance or dismantling.

11. Safety goggles shall be provided by the owner of the machine and shall be worn by persons employed on or around the machine engaged in mixing chemicals, welding, chipping, grinding, hammering, dressing bits or other operation hazardous to the eyes.

12. All tools and equipment shall be kept in good repair.

13. The machine shall have at least two, ten pound fire extinguishers of the sodium bicarbonate-carbon dioxide type readily available to the drilling floor.

14. No person shall smoke on the drilling floor, or within 50 feet of a wellhead where gas may be exposed to the atmosphere.

15. Pipe racks shall be adequately constructed and provision shall be made for the clearing or pinning of material on the rack to prevent lateral movement except when required.

16. All chain drives, belt drives, pinions, gears, couplings and other moving parts of the machine shall be covered or fitted with guards, adequate to prevent injury to personnel.

17. Where the owner of the machine requires that only his employees, inspectors and other persons authorized by him may have admittance to the well site, he shall erect notices to that effect.

18. The owner of the machine shall provide a medical kit at the machine and shall maintain an adequate stock of materials in it.

19. Forges and light plants shall not be within 50 feet of the well, and in no case shall be operated when oil or gas is exposed to the atmosphere.

20. Flame-type or open-element heaters shall not be operated when oil or gas may be exposed to the atmosphere.

21. Explosives shall not be stored within 500 feet of any well being drilled.

22. In a water-covered area, the foregoing shall apply only to the deck area and above or in such areas as designated by the Minister.

23. Welding shall not be done when oil or gas may be exposed to the atmosphere.

Schedule 2

WELL PLUGGING CODE

1. Casing, tubing and foreign material shall be removed from the well sufficiently to conform to the requirements of subsection 1 of section 39.

2. The plugging material shall be cement, without the addition of gravel or any non-drillable material, and with the addition of such special-purpose additives as may be required for acceleration, viscosity-reduction, etc.

3. Cement shall be in the form of a water-base slurry, having a minimum weight of 14.5 pounds per U.S. gallon.

4. Bridges shall be of wood or stone or gravel, or lead where required, or any combination of these or a special bridging device, but shall not include any non-drillable material.

5. Cement shall be deposited by displacement through tubing or drill pipe or dump-trailer, except that in holes where no liquid is present and which are more than 4 inches in diameter, deposition may be by gravity flow using a viscosity-reducing agent.

6. The Inspector may require that any plug be located.

7. The intervals between plugs shall be filled with water or drilling mud.

8. Cement plugs shall be set above and below each fluid (porous) zone and in addition shall be set across each oil and gas zone.

9. Cement plugs shall extend a minimum distance of 25 feet above and 25 feet below fluid zones.

10. In addition to plugs required by section 8, plugs shall be set in the top of the Cambrian, Trenton, Queenston, Clinton-Cataract, Guelph, Salina, Dundee and bed-rock formations, and such plugs shall have a minimum thickness of 25 feet.

11.—(1) The surface casing, or other casing one size smaller in lieu thereof, may be left in the hole.

(2) Where the Minister deems it in the public interest, he may require that surface casing, or other casing in lieu thereof, be left in the hole.

12. Where surface casing is left in the hole, it shall be fitted with a welded cap, or plugged with at least 10 feet of cement, and in all cases shall be cut off 3 feet below grade, except that where the well is in a water-covered area, surface casing shall be cut off at or below the bed of the body of water.

13. Where surface casing is removed, the hole shall be filled completely to surface with clay or sand or cuttings as the surface casing is withdrawn, except that a cement plug may be set between 3 feet and 6 feet from surface.

Form 101

The Energy Act, 1964

Licence No..........

LICENCE TO CONDUCT GEOPHYSICAL OR GEOCHEMICAL EXPLORATION FOR OIL OR GAS

Under *The Energy Act, 1964* and the regulations, and subject to the limitations thereof, this licence is issued to..

of..

to conduct geophysical or geochemical exploration for oil or gas.

This licence expires with the 31st day of December, 19....

This licence is not transferable.

Issued at Toronto, this......day of...................., 19....

....
(Chief Inspector) (Minister of Energy and Resources Management)

Form 102

The Energy Act, 1964

Licence No..........

LICENCE TO LEASE OIL OR GAS RIGHTS

Under *The Energy Act, 1964* and the regulations, and subject to the limitations thereof, this licence is issued to..

of..

to lease oil or gas rights from owners other than the Crown.

This licence expires with the 31st day of December, 19....

This licence is not transferable.

Issued at Toronto, this.....day of.................., 19....

....
(Chief Inspector) (Minister of Energy and Resources Management)

Form 103

The Energy Act, 1964

Licence No.........

LICENCE FOR A MACHINE FOR BORING, DRILLING, DEEPENING OR PLUGGING WELLS

Under *The Energy Act, 1964* and the regulations, and subject to the limitations thereof, this licence is issued to..

of..

in respect of the machine for boring, drilling, deepening or plugging wells described as follows:

....
(make) (model) (serial No.)

This licence expires with the 31st day of December, 19....

This licence is transferable from one person to another.

Issued at Toronto, this......day of.................., 19....

....
(Chief Inspector) (Minister of Energy and Resources Management)

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11. Blowout prevention equipment..

....

12. Ground elevation plus correction to rig floor..................(This *must* be determined by instrument).

13. The undersigned operator certifies that he has the right to bore or drill for gas and oil in the above location.

Remarks...

....
(signature)

Date..........................

....
(address)

*NOTE: Where the application is in respect of a well on land it shall be accompanied by a scaled plan certified by an Ontario Land Surveyor or Professional Engineer qualified to practise in Ontario or other person acceptable to the Minister showing:

(*a*) exact co-ordinates of the well from two intersecting sides of the lot;

(*b*) the elevation above sea level of the well site, including the datum from which it is derived;

(*c*) where the spacing unit is within a township lot, the position of the spacing unit within the lot; and

(*d*) such further information as the Minister may require.

Form 106

The Energy Act, 1964

PERMIT TO BORE, DRILL OR DEEPEN A WELL

Permit No............

Under *The Energy Act, 1964* and the regulations, and subject to the limitations thereof, this permit is issued to...

of...

to bore, drill or deepen a well, described as follows:

Location: County....................................... Township...............................

Lot.. Concession...............................

or number of licence of occupation or lease.........................

Co-ordinates: N-S.................... E-W.................

Name of well...

Depth not to exceed................feet.

This permit is issued subject to the special terms and conditions as shown on the back of this permit.

This permit expires with.......................................

This permit is not transferable.

Issued at........................, this......day of...................., 19....

.... (Inspector)

.... (Minister of Energy and Resources Management)

NOTE: The operator shall display this permit at the well site throughout the drilling operations.

FINAL PRODUCTION OF WELL	FINAL STATUS OF WELL
Gas............Mcf/day Oil.........bbl/day	....
Pressure..............psig	.... Symbol ☐

DRILLER'S LOG

Formation	Thickness	Total

CEMENTING RECORDS

PACKER RECORD

Type	Size	Depth

RECORD OF SPECIAL PRODUCTION STIMULATION TREATMENT

Date	

RECORD OF PRODUCTION TESTS (D S T, etc.)

Date	

Plugging Record — In the case of dry holes, the plugging method is to be described on Form 110 and attached hereto.

Remarks...

....

....

....
Signature Address Date

NOTE 1: The well name shall be that name which appears on Form 106 and shall not be changed without approval by the Minister.

NOTE 2: Elevations must be determined by instrument and must be certified by an Ontario Land Surveyor or other person acceptable to the Minister.

For Departmental Use

Date of Shipment of Samples...

Record of other Tests and Analyses..

....

Other Data and Remarks...

Form 108

The Energy Act, 1964

ANNUAL REPORT OF PERSON PRODUCING OIL

for year ending December 31st, 19....

Name of Producer...

Address.. Producing Licence No...........

NOTES: All wells operated are to be listed separately at Section 1, showing proper location, annual production and status.

Where grouping of wells for measurement of production has been permitted, show the total for those wells listed in the group.

Production and wells are to be summarized by fields or pools at Section 2. Quantities sold to or purchased from other producers are to be shown at Sections 2 and 3.

Where space is insufficient, attach additional similar listings.

1. WELL AND PRODUCTION STATISTICS

Description	Location				Net Production (Barrels)	Active (A) Suspended (S)
Name of Well	Township	Lot	Conc.	Field or Pool		

2. PRODUCTION AND WELL SUMMARY

Field or Pool in which Wells are Situated	Production in Barrels						Number of Wells Operated at December 31st					
							Producing		Water			Remarks
	Delivered to Refiner	*Other Sales	Private Use	Gross Total	*Less Purchases	Net Total	Active	Suspended	Injection	Supply	Disposal	
Totals												

3. PRODUCTION SOLD TO OR PURCHASED FROM OTHER PRODUCERS*

Name of Purchaser or Seller	Field or Pool Source	Quantity in Barrels

4. RECORD OF WELLS SOLD OR BOUGHT DURING YEAR

Description		Location				Name of Buyer (B) or Seller (S)
Well Name	Serial Number	Field or Pool	Township	Lot	Conc.	

Date............................ Signature..............................

NOTE: A producer's licence is suspended if he fails to make this report by the 15th day of February in the year following the year for which the report is to be made.

To: The Minister of Energy and Resources Management,
Name of Operator..............................
....
Address.......................................
....

Form 109

The Energy Act, 1964

ANNUAL REPORT BY PERSON PRODUCING, STORING, OR TRANSMITTING GAS
for the year ending December 31st, 19......

NOTES: (1) All wells operated are to be listed. Show storage wells separately.
(2) Where group metering is permitted, show the total production for those wells listed in the group.
(3) Where space is insufficient, attach additional similar listings. Producing Licence No........

1. Production Statistics						2. Pressure Statistics			
Well Name	Township	Lot	Con.	Field or Pool	Natural gas produced (Mcf.)	Shut-in well-head pressure p.s.i.g.	Shut-in time (Hrs.)	Active (A) or Susp. (S)	Open flow (If measured)

3. Field or Pool Summary			
Field or Pool	Natural gas produced (Mcf.)	Number of Wells	
		Active	Susp.
Totals			

4. Gas Purchases			
Name of Vendor	Quantity	Price per Mcf.	Total Cost
Totals			

5. Storage Gas		
Quantity In	Quantity Out	Net
....	....	....

6. Sales of Gas to Distributors or Transmitters

Name of Purchaser	Quantity	Price per Mcf.	Total Value

7. Sales Directly to Consumers

Number of Consumers .... Quantity ....

8. Free Gas

Number of Consumers .... Quantity ....

9. Gas Used by Producer, Storer or Transmitter ....

10. Gas unaccounted for ....

11. Total Pipelines in use at end of year, stated in miles

Gathering .... Transmission .... Distribution, exclusive of service lines ....

12. Record of Wells Sold or Bought during Year

Description		Location				Name of Buyer (B) or Seller (S)
Well Name	Serial Number	Field or Pool	Township	Lot	Con.	

NOTE: In paragraph 12, show the name of person wells were sold to ("B") or bought from ("S") and completest possible details of well description and location.

.... (date)

.... (signature)

NOTE: A producer's licence or a transmitter's licence is suspended if he fails to make this report by the 15th day of February in the year following the year for which the report is to be made.

Form 110

The Energy Act, 1964

RECORD OF THE PLUGGING OF A WELL

To: The Minister of Energy and Resources Management:

WELL NAME..

Name of owner of well...

Address...

Lease number............ Year drilled............

Name of Landowner when drilled.................... Land well No.............

County.. Township...................................

Lot........... Concession........... Total depth............

Co-ordinates: N-S...

E-W...

Plugging contractor.................................... Licence No.............

Plugging supervisor...

Plugging dates...

Well data: Thickness of drift..

Depths of all water pays: Fresh..

Mineral..

Depths of all gas pays..

Present flow and pressure.......... Mcf.......... Psig..........

Depths of all oil pays...

Present production.................... B.O.P.D.

CASING RECORD

Size	Seated at	How Set	Ft. Recov.	Ft. Left In

Describe Plugging Method in Complete Detail

Signature...............................

Address...............................

....
Date Form Completed

Form 601

The Energy Act, 1964

WARNING

This work, appliance or equipment has been tagged under the provisions of *The Energy Act, 1964*.

UNAUTHORIZED USE PROHIBITED

Date..................................... ....

(Inspector)

To: ....

Inspector under *The Energy Act, 1964*

Department of Energy and Resources Management,
880 Bay Street,
Toronto 5, Ontario.

I have remedied or repaired the work, appliance or equipment to which you attached this tag in accordance with your requirements.

Signature...............................

Title.....................................

Company...............................

Address.................................

Date..................................

Form 602

The Energy Act, 1964

In the matter of proposed summary proceedings against...
....
....

PERMISSION TO PROSECUTE

1. I, ...,

Minister of Energy and Resources Management, hereby give permission to.............................
....
....

to lay an information against...

under section 9 of *The Energy Act, 1964*.

2. This permission is given under section 9 of *The Energy Act, 1964*.

Dated at Toronto, this......day of...................., 19....

....

(Minister of Energy and Resources Management)

(832)

50

M-O&G-LE-68
Oil & Natural Gas Lease

Commonwealth of Pennsylvania
Department of Forests and Waters
Division of Minerals
P.O. Box 1467
Harrisburg, Pennsylvania 17120

Contract No. ____________

OIL AND NATURAL GAS LEASE FOR THE LANDS BENEATH LAKE ERIE WITHIN THE JURISDICTION OF THE COMMONWEALTH OF PENNSYLVANIA

THIS AGREEMENT made and entered into on this day of 19 , by and between the COMMONWEALTH OF PENNSYLVANIA, acting through the DEPARTMENT OF FORESTS AND WATERS, hereinafter designated "Lessor," and ________________________________ ____________________, a ____________________ Corporation, hereinafter designated "Lessee," with its principal place of business at ________________________________ and authorized to do business in the Commonwealth of Pennsylvania.

WITNESSETH: THAT,

WHEREAS, Lessor is authorized by Act 293, dated July 5, 1957, amending the Administrative Code of 1929, (P. L. 177), Article XVIII, Section 1802, paragraph (g), to make and execute contracts or leases in the name of the Commonwealth for the removal of oil and natural gas beneath those waters of Lake Erie owned by the Commonwealth whenever it shall appear to the satisfaction of Lessor that it would be for the best interests of the Commonwealth to make such removal; and

WHEREAS, Lessor made a determination that the leasing of oil and natural gas rights in the premises hereinafter described will be for the best interests of the Commonwealth and authorized leasing of the same; and

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WHEREAS, the proposed leasing of said lands was duly advertised as required by law. Upon the opening of the bids, submitted pursuant to such advertising, Lessee herein was found to be the highest responsible bidder.

NOW THEREFORE, in consideration of the sum of Dollars ($), paid to Lessor by Lessee (the receipt whereof is hereby acknowledged by Lessor) and other mutual covenants and agreements hereinafter set forth, Lessor does hereby grant, demise, lease, and let exclusively unto Lessee for the purpose of exploring for, drilling for, operating for, producing, removing, and disposing of oil, natural gas, and liquid hydrocarbons; at locations subject to the approval of Lessor, the drilling of wells, the laying of pipelines, including any and all necessary appurtenances, attachments and cathodic protection devices and the building and installation of approved tanks, towers, stations, and structures thereon to produce, save, take care of, and transport said products, in lands beneath all that/those certain block/blocks of Lake Erie comprising acres, more particularly described on the Oil and Natural Gas Lease Attachment, identified as Exhibit "A" and as shown on the Map, identified as Exhibit "B" which are attached hereto and made a part hereof, hereinafter referred to as the "leased premises." It is understood that the aforesaid acreage and the location shown on the Map, identified as Exhibit "B" are approximate. For the purpose of calculating any payments based on acreage, the acreage aforementioned will be used.

M-O&G-LE-68
Oil & Natural Gas Lease

1. INTERPRETATION AND LIMITATION OF LEASE

1.1 The rights granted in this lease apply only to oil, natural gas and liquid hydrocarbons.

1.2 In this lease, oil, natural gas, and liquid hydrocarbons shall not mean and include helium or any sulphur produced in association with the foregoing.

1.3 Rights to all minerals and substances other than oil, natural gas and liquid hydrocarbons on or beneath the bed of Lake Erie are reserved to the Commonwealth of Pennsylvania.

1.4 The right to use any part of the leased premises for gas or LPG (fluids) storage is expressly reserved to the Commonwealth of Pennsylvania.

2. TERM OR PERIOD

2.1 It is agreed that this lease shall remain in force for a term of ten (10) years from the date first written above, subject to all terms and conditions hereinafter set forth and shall continue from year to year thereafter so long as oil or gas is produced in paying quantities from said land or as long as Lessee is engaged in bona fide attempts to secure or restore the production of oil, natural gas and liquid hydrocarbons by conducting drilling, or reworking operations on the leased premises or engaged in the abandonment, or removal of equipment therefrom.

2.2 In the event that Lessee is engaged in drilling operations or is prevented by weather or water conditions from carrying on drilling operations in progress at the expiration of the ten (10) year term, Lessor may upon application in writing within thirty (30) days following the ten (10) year term extend the lease for a period not to exceed six (6) months.

2.3 The months from November to March, both inclusive, shall not be computed in the extended period.

3. RENTAL

3.1 The first annual rental will be the amount of the bonus bid for the above described premises and is payable upon execution of this lease by Lessee.

3.2 After the first year, Lessee agrees to pay Lessor an annual rental in advance for the above described premises at the rate of ONE DOLLAR ($1.00) per year for each acre of this lease retained by Lessee. The rental shall be paid on or before the anniversary date of this lease. Each successive rental thereafter shall be paid on or before the anniversary date of this lease.

3.3 The completion of each well on the leased premises to or through the Ordovician Queenston Formation, or shallower depths if approved as stipulated, shall reduce the rental set out in the preceding paragraph by the amount of rental on the number of acres attributable to each well as provided in the section entitled, "SUBSEQUENT WELLS," which reduction shall become effective on the next rental date after such well has been completed and shall apply whether the well is a producer or a dry hole. If such wells are drilled on a unit created by a spacing order of the Pennsylvania Oil and Gas Conservation Commission, or on a unit created by a voluntary unitization agreement entered into with the approval of Lessor, a well drilled on such unit shall reduce the rental prescribed above by the amount of rental attributable to the acreage contained in the portion of the leased premises included in such unit.

4. OIL ROYALTY

4.1 Lessee shall pay to Lessor, as royalty, one-eighth (1/8) of the field price per barrel (42 U.S. Gallons) at 60° F. produced and saved from the leased premises for all oil, condensate and other liquid hydrocarbons of like grade and gravity which prevails in that area on the day such oil and other products are run into the pipeline or into storage tanks.

4.2 Lessor may at his option, however, demand that Lessee deliver to the credit of Lessor, as royalty, free of cost, in the pipeline to which Lessee may connect its wells, the equal one-eighth (1/8) part of all oil, condensate, and other liquid hydrocarbons produced and saved from the leased premises.

4.3 If gas, oil, condensate, and other liquid hydrocarbons, each in paying quantities, should be developed from the same well, then the gas and the oil, condensate and other liquid hydrocarbons shall be saved.

4.4 Lessee shall gauge, measure, sample, and test all petroleum and petroleum products in accordance with standard practices as outlined in American Petroleum Institute Standard 2500, January 1, 1955, or as subsequently amended by the same authority, and at a temperature base of 60° F. Lessee shall provide tanks for accurately measuring the crude oil produced from the lease. Positive copies of 100 percent capacity tank tables are to be furnished to Lessor or other acceptable standards of measuring production.

5. GAS ROYALTY

5.1 To pay Lessor, as royalty, Four Cents ($0.04) per thousand cubic feet (Mcf) or one-eighth (1/8) of the market value, thereof, at the mouth of well, whichever is higher for all gas and other gaseous substances produced and saved from each gas well drilled on the leased premises.

6. SHUT-IN WELLS

6.1 If at any time or times there is on the leased premises a well or wells capable of producing oil or gas or both and the well or wells are shut-in, suspended, or otherwise not produced and the gas is not used or marketed therefrom during any year ending on an anniversary date of this lease, Lessee shall pay Lessor at the expiration of each said year for that year a sum equal to Two Dollars ($2.00) per acre for the number of acres then covered by this lease for each such well and each such well shall be deemed to be a producing well hereunder. The failure to make such payment shall subject the lease to forfeiture.

7. GAS MEASUREMENT

7.1 All gas producing wells shall be equipped with adequate facilities for continuously metering gas suitably safeguarded from weather and from interference by unauthorized persons, and no gas shall be produced at a well unless it is metered, except that Lessor may give permission to dispense with the installation of a meter or facilities for metering and permit group meter measurements instead. The meter charts and relevant records shall be kept in a permanent file and be made available to Lessor on request.

7.2 Where, in the opinion of Lessor, adequate measurements are not being made of the gas produced from a well or wells, Lessor may require that the well or wells be closed in until such time as provisions for adequate measurements have been made.

7.3 The volume of gas produced, saved, and marketed shall be measured according to Boyle's Law for the measurement of gas under varying pressures with deviations therefrom, as provided in paragraph e. below, on the measurement basis hereinafter specified and shall be determined as follows:

a. The unit of volume for the purpose of measurement shall be one (1) cubic foot of gas at a temperature of sixty degrees (60°) Fahrenheit and an absolute pressure of 14.73 pounds per square inch.

b. The average absolute atmospheric pressure shall be assumed to be 14.4 pounds to the square inch, irrespective of actual elevation or location of Point of Delivery above sea level or variations in such atmospheric pressure from time to time.

c. The temperature of the gas passing the meters shall be determined: (1) By the continuous use of a recording thermometer so installed that it may properly record the temperature of the gas flowing through the meters. The arithmetic average of the temperature recorded each 24-hour day shall be used in computing gas volumes; (2) If a recording thermometer is not installed, or if installed and not operating properly, an average flowing temperature of fifty degrees (50°) Fahrenheit shall be used in computing gas volume.

d. The specific gravity of the gas shall be determined by tests made by the use of an Edwards or Acme gravity balance, at intervals of three (3) months, or at such intervals as are found necessary in practice. Specific gravity so determined shall be used in computing gas volumes.

e. The deviation of the natural gas from Boyle's Law shall be determined by tests at intervals of three (3) months or at such other shorter intervals as are found necessary in practice. The apparatus and the method to be used in making said test shall be in accordance with the recommendations of the National Bureau of Standards of the Department of Commerce, or Report No. 3 of the Gas Measurement Committee of the American Gas Association or any amendments thereof, or any other mutually agreed upon method. The results of such tests shall be used in computing the volume of gas delivered hereunder.

7.4 No gas from any gas well, except such as is produced in a cleanup period not to exceed 48 hours after any completion or stimulation operation, plus that used for the controlled testing of the well's potential in a period not to exceed 24 hours, plus that used in any operational requirements, shall be permitted to escape into the air. Extensions of these time periods shall be granted by Lessor upon application if the Lessee demonstrates sufficient good cause.

7.5 All gas wells capable of production shall be equipped with wellhead controls adequate to properly contain and control the flow thereof.

7.6 Lessor may require the periodic testing of any gas well in such a manner as Lessor may prescribe in order to establish the producing capacity and characteristics of the well.

8. STATEMENT

8.1 Lessee shall submit statements to the office of Lessor at Harrisburg, Pennsylvania, by individual wells of the production and sales of oil, gas, other hydrocarbon products, and other products not later than the twenty-fifth (25th) day of each calendar month covering production and sales for the preceding calendar month.

9. PAYMENTS

9.1 Lessee shall be held responsible for the payment of all royalties, which shall be mailed to the office of Lessor at Harrisburg, Pennsylvania and made payable to Lessor. Payments of royalties shall be made not later than the twenty-fifth (25th) day of each calendar month covering production or sales during the preceding calendar month.

10. PROTECTION AND CONSERVATION

10.1 Lessee agrees to conduct all operations in such a manner as to comply with the provisions set forth in the STIPULATIONS FOR THE PROTECTION AND CONSERVATION OF THE SUBMERGED LANDS AND THE WATERS OF LAKE ERIE, identified as Exhibit "C" attached hereto and made a part hereof.

11. OPERATIONS

11.1 Lessee agrees that it will carry on operations under this agreement with all due diligence and in a competent and workmanlike manner, in accordance with the best offshore oil and gas field practices.

12. FIRST WELL

12.1 Lessee shall drill a well on each block leased or on unitized acreage containing a portion of a lease block, but the well need not necessarily be on the portion of the lease block contained within the unit. Lessee agrees to commence and proceed with operations for the drilling of a well to the Ordovician Queenston Formation, at a location approved by Lessor, within five (5) years from the date first written above, and shall continue operations in a workmanlike manner to complete said well, and all wells herein stipulated, with due diligence. If, however, gas or oil or both are found in marketable quantities in a shallower formation, that well may satisfy the first well requirements of this paragraph upon the written approval of Lessor. In the event, the aforesaid well is not commenced within the above mentioned five (5) year period, the lease shall be terminated in its entirety.

13. WELL SPACING

13.1 All wells drilled in Lake Erie in the absence of a spacing order of the Pennsylvania Oil and Gas Conservation Commission shall be subject to a spacing density of one gas well per tract (approximately 630 acres - 1 Minute of Latitude by 1 Minute of Longitude). Oil well spacing will be no more than one well per approximately 40 acres, or 16 wells per tract. Exceptions to these spacings may be allowed by Lessor upon proper justification by Lessee. Such exceptions must be authorized in writing.

13.2 The first well in each tract (1 Minute of Latitude by 1 Minute of Longitude) is to be located in the center of the northwest quarter of the northwest quarter (NW NW) of the tract for flexibility in well spacing programs, subject to approval of Lessor. Exceptions to this location may be allowed if Lessee shall submit to Lessor the information upon which such exception is based. Such exceptions must be authorized in writing.

13.3 The spacing of wells shall also be subject to all regulations and restrictions imposed by the United States Coast Guard and the United States Army Corps of Engineers in regard to shipping lanes, docks, and other areas under their jurisdiction.

14. SUBSEQUENT WELLS

14.1 If the well or wells required under Paragraph 12.1 hereof or any subsequent well produces oil or gas or both in marketable quantities, then Lessee shall drill an additional well or wells through the producing formation during the same lease year. Lessee will commence and proceed with the drilling of at least one (1) well to or through the producing formation on each lease block, each and every lease year thereafter so long as successive wells have marketable production. Wells may be drilled on a unit containing a portion of a lease block, but not necessarily on the lease block portion of the unit. If Lessee concludes that an additional well or wells is not justified, then Lessee shall submit to Lessor the information upon which the conclusion is based. If Lessor determines upon review of such information that an additional well should be drilled, then Lessee shall have the option of drilling an additional well within six (6) months from Lessor's written determination or releasing all of the acreage covered by the lease except for forty (40) acres around each well from which oil is produced as the principal product and six hundred and thirty (630) acres around each well from which gas is being produced as the principal product.

14.2 Lessee shall not be required under this provision to drill more wells than required or allowed under any spacing order, rule, or regulation of the Pennsylvania Oil and Gas Conservation Commission, or in the absence of any such order, more than one well for each forty (40) acres where oil is being produced as the principal product of such well, or more than six hundred and thirty (630) acres where gas is being produced as the principal product of such well.

14.3 The amount of acreage included in a spacing unit by the Pennsylvania Oil and Gas Conservation Commission or in the absence of an order by such Commission, forty (40) acres where oil is being produced as the principal product of such well, or six hundred and thirty (630) acres where gas is being produced as the principal product of such well, shall be referred to elsewhere in the lease as acreage attributable to each well.

15. RESTRICTED AND RESERVED AREAS

15.1 The areas in Lake Erie within one-half mile of the International Boundary, the Ohio Boundary, and the New York Boundary are restricted drilling areas. No wells may be drilled in these areas without written permission of Lessor. These areas may be drained without a competitive offset program unless geological conditions warrant closer spacing. Where feasible, these areas will be unitized for proper spacing and management.

15.2 An area in Lake Erie along the shoreline and in the vicinity of the Presque Isle Peninsula is reserved. This area is shown on the Map, identified as Exhibit "B" which is attached hereto and made a part hereof.

16. DEVELOPMENT

16.1 Lessee agrees to conduct the drilling of all wells as a reasonable and prudent operator would drill under the same or similar circumstances. After discovery of oil or gas on the leased premises, Lessee shall develop and produce all wells from the described leased premises in an efficient and economic manner, without waste, and to the best advantage of Lessor. Lessee will plan and develop all wells in accordance with the rules and regulations of the Oil and Gas Division, Pennsylvania Department of Mines and Mineral Industries.

16.2 It is understood and agreed that Lessee is privileged to develop oil or gas from formations shallower or deeper than the Ordovician Queenston Formation provided that commitments and provisions of this lease are at all times fulfilled. The operator shall apply the same degree of precaution and control as outlined for the Ordovician Queenston Formation operations to drilling, casing, and completing operations of the other formations, both below and above the Queenston Formation.

17. OFFSETS

17.1 Lessee agrees to promptly offset within ninety (90) days any wells located on other blocks owned by the Commonwealth leased to other parties than Lessee at a lesser royalty or owned by the States of Ohio or New York or the Canadian Province of Ontario, which are within 2,260 feet of any boundary described in this lease and are producing gas or oil in marketable quantities; or any well that is completed within the radius of the drainage area set by an order of the Pennsylvania Oil and Gas Conservation Commission. This provision may be waived by Lessor in writing upon Lessee's application, when evidence shows that such offsetting well is unnecessary or economically unsound. However, if Lessor determines in writing that an offsetting well should be drilled, Lessee will have the option of drilling the well as required or paying to the Commonwealth compensatory royalty on production from the offset well. This payment shall be based on the ratio the affected acreage bears to the total acreage drained by the well. Lessee may at its option release all of the acreage of the leased premises except forty (40) acres around each well from which oil is being produced as the principal product and six hundred and thirty (630) acres around each well from which gas is being produced as the principal product. Lessee may also release that drainage acreage attributable to a well by an order of the Pennsylvania Oil and Gas Conservation Commission if the affected acreage falls within an area subject to such a spacing order.

17.2 In the event that Lessee is prevented by weather or by ice conditions in the lake from drilling a required offset well during the ninety (90) day time period, Lessee may apply to Lessor for an extension of the time limit not to exceed six (6) months. The months from November to March, both inclusive, shall not be computed in the extended period.

17.3 No well on the leased premises shall be shut-in if drainage will occur through offsetting wells within the aforeprescribed distances for oil and gas wells. If such offsetting gas wells are on compression, the offset wells on the leased premises shall be placed on compression.

17.4 Lessee agrees that any well along the boundary line, contingent to other lands where oil and gas are owned by the Commonwealth, shall be located at least 660 feet from such boundary; or that distance from such boundary line which will be the radius of the drainage area set forth by an order of the Pennsylvania Oil and Gas Conservation Commission, if the area is subject to such a spacing order. Upon application by Lessee, this provision may be waived in writing by Lessor when deemed in the best interest of the Commonwealth and not in an area subject to a spacing order of the Pennsylvania Oil and Gas Conservation Commission.

18. UNITIZATION

18.1 Lessee shall have the right at any time, where this lease is offsett by blocks on which oil and gas rights are leased to other parties, to unitize this lease in whole or in part to secure the most efficient and economical development and production of the oil and gas resources of the reservoir or reservoirs and in the best interests of sound management and production practices. Lessee may participate in such joint operating and development agreements to prevent drilling of an excessive number of wells, or of wells located too close to the boundary of the leased premises. Such joint operating agreements and termination thereof shall be approved in writing by Lessor. If such joint operating agreements or unit agreements are entered into pursuant to a valid Spacing or

Integration Order of the Pennsylvania Oil and Gas Conservation Commission, the approval of Lessor shall not be required.

18.2 Drilling, or reworking operations upon, or production of oil and gas from, any part of any such unit shall be treated for all purposes hereunder as operations upon or production from the leased premises.

18.3 Upon production from any part of any such unit, Lessor shall be entitled to and Lessee shall pay royalties calculated as follows: there shall be allocated to the portion of this lease included in such unit a fractional part of such production on the basis the ratio of the acres from the leased premises included in such unit bears to the total number of acres included in the unitized area and Lessor shall be entitled to the royalties provided for in this lease on such fractional part of such production and no more; provided, that if Commonwealth authorities shall prescribe a different method of allocation, the method so prescribed shall prevail.

19. PIPELINES

19.1 Lessee is herewith granted the right to lay any necessary pipelines at or below the level of the lake bottom on or under the leased premises for the sole purpose of removing oil, gas or other materials from the block or blocks under lease. Any pipelines under shipping lanes and anchorages must be buried. A route map for each line shall be submitted to the Lessor, the United States Coast Guard, and the United States Army Corps of Engineers for their approval in writing as to location ninety (90) days prior to the laying of that pipeline.

19.2 Where the Lessee's pipelines cross offshore blocks not already leased to it, Lessee must enter into a pipeline right of way agreement with Lessor. Lessor reserves the right to grant pipeline rights of way across the block or blocks leased to other lessees of the Commonwealth providing the operations of Lessee are not unduly hampered thereby.

19.3 All pipelines shall be laid on or below the lake bottom. Before a pipeline may be used to transport any fluids not indigenous to the waters of the lake, it shall be tested with fresh water to a pressure of twice the anticipated working pressure. No gas or fluids may be transported in pipelines until approval is given by Lessor.

20. LESSEE'S USE

20.1 Lessee shall have the privilege of using sufficient gas from the leased premises, free of royalty, to run all machinery necessary for drilling thereon.

21. DRILLING

21.1 Prior to beginning any drilling operations, Lessee shall submit to Lessor, the United States Coast Guard and the United States Army Corps of Engineers, for their approval, a plan of the drilling program to be carried out. This plan shall include:

(a) a location plat of the proposed well, Scale 1 inch = 400 feet, which shows and contains: (1) the proposed drilling unit and its position in the lease block; (2) its distance from the boundary of the proposed drilling unit; and (3) unitization with adjacent tracts.

The well location must be surveyed to the nearest one-half second (1/2") of longitude and latitude. The well location shall be verified and amended as required by precise survey with the drilling rig on location and the elevation above sea level provided. If the well is to be directionally drilled, the projected bottom hole location of the well is to be shown;

(b) designation of the well by number and lease block;

(c) the geological formation to be tested or used and the proposed total depth;

(d) the type of drilling tools or equipment to be used;

(e) the plan for disposal of water, drilling fluid, and other waste substances resulting from obtained or produced in connection with exploration, drilling, or production of oil and gas;

(f) a detailed plan for casing and cementing of the proposed well;

(g) a detailed plan for plugging and abandoning the proposed well if the well should prove nonproductive.

21.2 No well shall be commenced, deepened, reopened, or plugged back without authorization of Lessor in writing and before a permit has been issued by the Oil and Gas Division of the Pennsylvania Department of Mines and Mineral Industries. Lessor shall be notified at or immediately prior to the start of drilling operations.

21.3 The location of a well shall not be changed without prior written approval of Lessor.

21.4 With the first show of gas or oil, drilling operations must be suspended and the casing tested and found to be free from all leaks before drilling is continued.

21.5 At the end of every drilling or plugging operation, Lessee shall ensure that any platform, piling, anchor post or other obstructions are removed as soon as is reasonably possible, and in any case within thirty (30) days. A permanent platform of approved design may be installed for the production of oil or gas.

22. IDENTIFICATION

22.1 Lessee shall display a prominent sign at all structures placed in the lake for drilling, producing, or reconditioning a well, or for handling or processing produced fluids. This sign shall be located in a conspicuous place and shall include the name of Lessee, the name and number of the well or facility, and a description of the well or facility location by latitude and longitude. The sign shall not be removed or changed without written approval of Lessor. In case of lake bottom completions or subbottom completions, identification satisfactory to Lessor shall be placed at the wellhead.

23. DEVIATION AND DIRECTIONAL WELL SURVEYS

23.1 Lessee shall drill a straight hole to the best of his ability. The maximum point at which a well penetrates a producing formation shall not vary unreasonably from the vertical drawn from the center of the hole at the surface. Minor deviations will be permitted, for short distances, to straighten the hole, to sidetrack junk or to correct other mechanical difficulties.

23.2 Lessee shall run a device for measuring deviation from the vertical every five hundred (500) feet and at the total depth and shall provide Lessor with this information.

If Lessor determines from this information that a well has been deviated excessively, he shall have the right to require Lessee to have a complete angular deviation and directional survey made in the well by an approved well surveying company and certified as to correctness at Lessee's sole risk and expense. In the event the survey reveals any unreasonable violations of the applicable well location or spacing regulations, Lessor may either require the excessively deviated well to be redrilled or to be plugged and abandoned by Lessee.

23.3 If Lessee fails to take a deviation survey, Lessor may order that, until the survey is made, no further drilling be done: or if the well has been placed on production, no further production be taken.

23.4 Lessee may conduct directional drilling operations upon the approval of Lessor in writing so long as, at depth, there is no encroachment upon adjoining leaseholds or drilling units. Lessee shall make written application to Lessor and provide the following information:

(a) names of field or area, pool, block, tract and well number;

(b) description of the well location and of the target bottomhole location in feet from the two nearest lease boundaries;

(c) reason for the proposed intentional deviation;

(d) names and addresses of the offsetting lessees and a statement that each has been sent a copy of the application and a map by registered mail, and the date of such mailing. The map must be drawn to a suitable scale which shows the well; all offsetting leases and the wells located thereon; the pool in which they are completed; and the names of the offsetting lessees.

23.5 Within thirty (30) days after the completion of an intentionally deviated well, a complete angular deviation and directional survey of the well obtained by an approved well surveying company and certified as to correctness shall be furnished to Lessor.

24. BLOWOUT PREVENTERS AND CASING HEADS

24.1 Lessee shall maintain at all times the casing control equipment in such condition that will effectively control any oil, gas, or water encountered during operations in a well being drilled, tested, completed, or reconditioned. All drilling wells or wells being serviced by a rig, shall be equipped with working blowout control equipment tested to twice normal hydrostatic pressure for the depth drilled that will completely close off the open hole and will completely close off around any equipment being employed in the well, and will be equipped with a bleed-off valve of the proper size and working pressure. If, the blowout preventer is hydraulically operated, adequate pressure shall at all times be available for efficient operations. Blowout control equipment must be capable in case of an emergency of shutting in the well at a point at least fifty (50) feet from the wellhead.

24.2 When rotary drilling equipment is used during drilling, all wells shall be fitted with a suitable valve in proper working order for the purpose of shutting off the hose connections should the hose blow out.

24.3 All wells shall be equipped with casing heads of rated working pressure of twice normal hydrostatic pressure for the depth drilled, with adequate connections and valves available to permit pumping mud-laden fluid between any two strings of casing at the surface. Reconditioning shall be required on any well showing pressure on the casing head or leaking gas or oil between the oil string and next larger size casing string, when in the opinion of Lessor such pressures or leakages assume hazardous proportions or indicate the existence of underground waste. Mud-laden fluids may be pumped between any two strings of casing at the top of the hole, but no cement shall be used except by special permission of Lessor. No casing shall be perforated until adequate control equipment has been installed and in good working order. Such control equipment shall consist of Master Valve and Lubricator, or their equivalent. The entire equipment shall be in good working order and condition at all times.

24.4 While a well is being drilled, Lessee shall test control equipment daily and record the results of such tests daily.

24.5 Whenever an inspection shows that the casing or control equipment at a well is not adequate, Lessor may prescribe remedial measures which shall be complied with before any further drilling.

25. DRILLING MUDS

25.1 When drilling with rotary tools, drilling mud of sufficient weight, capable of controlling formation pressures and preventing oil and gas blowouts or flows of water, shall be maintained on the location of a drilling well at all times.

26. CASING PROGRAMS

26.1 All casing, tubing, and equipment used in the drilling of a well shall be in good condition and adequate for the depths to be drilled and the pressures that may be encountered.

26.2 Lessee shall comply with the oil and gas statutes, rules and regulations of the Commonwealth with regard to preventing the escape of oil, gas, or water out of one stratum into another, preventing the pollution of any fresh water supply and preventing blowouts.

26.3 When drilling with cable tools, a conductor string of new or reconditioned casing shall be driven into the lake bed. All wells must be equipped with a string of surface casing which shall be set and cemented at a sufficient depth below the top of a competent rock formation so that all fresh water reservoirs will be confined. Lessor shall set depth requirements for each well based on the depth of fresh water reservoirs in the area. This surface casing shall be new or reconditioned of sufficient test to withstand pressures for the depth at which it is run. Sufficient cement shall be used to fill the calculated annular space back of the surface casing to the lake bed plus 15%. Cement shall be allowed to stand a minimum of 12 hours under pressure and a total of 24 hours before drilling plug or beginning tests. The term "under pressure" as used herein shall be considered as being complied with, when one or more back pressure valves are found to be holding. Casing shall be tested by pump pressure to at least 1,000 pounds per square inch. If, at the end of 30 minutes the pressure shows a drop of 50 pounds per square inch or more, the casing shall be considered unsatisfactory for its purpose.

After the corrective operation, the casing shall be again tested in the same manner before drilling continues.

26.4 When cable tool drilling is used, intermediate strings of casing shall be set inside the surface casing if it is necessary to confine any gas, oil, or water originating from intermediate horizons prior to the setting and cementing of the production string of casing. Intermediate casing may be cemented through any potential producing horizon with cementing procedures approved by Lessor.

26.5 The producing or oil string shall be new or reconditioned seamless pipe of not less than 4-1/2 inch outside diameter with a mill test of at least twice normal hydrostatic pressure for the depth drilled. After cementing, the casing shall be tested by pump pressure to at least twice normal hydrostatic pressure for the depth drilled. If at the end of 30 minutes, pressure shows a drop of 50 pounds per square inch or more, the casing shall be repaired sufficient to withstand the pressure test described herein. After the corrective operation, the casing shall again be tested in the same manner. Cementing shall be made by pump and plug method. Sufficient cement shall be used above the shoe to fill the calculated annular space back of the casing to the lake bed plus 15%. Cement shall be allowed to stand a minimum of 24 hours before drilling plug or initiating tests. In the event the producing string is set through all known producing formations, a minimum of 20 feet of cement shall remain in the bottom of the casing.

26.6 The waiting period on cement may be reduced from 24 hours upon approval of Lessor.

27. COMPLETION OF WELLS

27.1 All reasonable preparations and precautions shall be made before a well is drilled in for the preventing of waste and the contamination of the lake by oil, gas or well fluids. Reasonable provision shall be made for producing and storage equipment before a well is placed on production.

27.2 Lessee shall insure that the production casing is cemented to surface before production commences.

27.3 Lessee shall complete and connect all producing wells to pipelines as near as practical to the level of the lake bottom. The wellhead is to be encased in a cellar below lake bottom. The maximum height of the wellhead assembly above the lake bed may be 2-1/2 feet upon written approval of Lessor. All wells shall be cleaned, tested, and produced in a manner to prevent pollution of the lake. Lessee shall employ procedures and use equipment that will eliminate or minimize any fire hazard. No production, processing, or any other type of platform can be erected unless approved in writing by Lessor, the United States Coast Guard, and the United States Army Corps of Engineers.

27.4 When and if the area is designated as a primary trawling area, the wellhead shall be fitted with a trawl deflector of approved design. When and if the area is designated for other types of commercial fishing, the wellhead shall be fitted with a protective device of approved design.

27.5 Lessee shall not commingle the production from two or more reservoirs unless specific written permission for such commingling has been granted by Lessor.

27.6 An accepted device (tubing safety valves) approved by Lessor shall be installed below the elevation of the lake bottom on all producing wells in such a manner that will prevent the escape of oil, gas, or water in the event the wellhead equipment is damaged.

27.8 If shown to be more practicable, other completion methods may be used if approved in writing by Lessor.

28. REPAIR OF EQUIPMENT AND PREVENTION OF WASTE

28.1 Lessee shall at all times during the continuance and delivery of oil, gas and liquid hydrocarbons to the market, keep, maintain and repair its pipelines and equipment to the end that there shall be no leaks or waste of oil, gas and liquid hydrocarbons. Lessee shall promptly repair or cause to be repaired any structures or other facilities which may be damaged by his operations.

28.2 Lessee, his agents, contractors and subcontractors, shall not allow any well to blow open, except in case of an emergency, over twenty-four (24) hours after drilling-in. Lessee shall pay Lessor at the regular royalty rate for any gas allowed to escape, except in case of an emergency, after this initial twenty-four (24) hour period. Such gas shall be estimated by a method approved by Lessor in writing.

28.3 After an initial open flow test has been taken, all future determinations of open flow potential shall be made by the United States Bureau of Mines, Back-Pressure Test Method (USBM-Monograph 7) or by other methods standard to the industry and approved by Lessor.

28.4 The determination of the initial open flow of a well shall be made before any attempts are undertaken to increase the flow of such well through mechanical or chemical stimulation.

28.5 At least every six (6) months, Lessee shall determine the open flow of each producing well as required in Section 28.3 and will also take a twenty-four (24) hour reservoir pressure test and shall furnish Lessor with the results of all such tests. Shut-in pressures shall be taken with a deadweight gauge, after a minimum shut-in time period equal to the period required to reach stabilization or twenty-four (24) hours, whichever is the lesser.

29. APPLICABILITY TO OTHER OPERATIONS

29.1 In addition to being applicable to newly drilled wells, the applicable provisions of the foregoing sections shall be in effect for deepening, plug back and conversion operations.

30. TEMPORARY ABANDONMENT

30.1 Lessee shall not temporarily abandon any well without written permission from Lessor. Permission for such temporary abandonment may be granted by Lessor upon written application by Lessee showing sufficient good cause.

30.2 Upon termination of the period of temporary abandonment, Lessee must either resume operations or permanently plug and abandon the well as hereinafter provided.

31. PERMANENT ABANDONMENT

31.1 If a new well is found to be dry or nonproductive, it shall be plugged and abandoned as hereinafter provided. Lessee shall give prior notice to Lessor of the intent to plug and abandon a new well so that plugging operations may be witnessed.

31.2 If a well that has been on production is to be plugged and abandoned, Lessee shall notify Lessor and the Oil and Gas Division, Pennsylvania Department of Mines and Mineral Industries, when actual plugging and abandonment operations are to be started so that they may be witnessed.

31.3 Lessee shall not abandon any well, wells, or lease without having plugged and abandoned such well or wells and effected the adequate restoration of the lake bed. A plugging certificate shall be filed with the Oil and Gas Division, Pennsylvania Department of Mines and Mineral Industries.

32. PLUGGING METHOD

32.1 All wells shall be plugged by filling the hole completely with cement including the inside and annulus of all casing left in the well. Any casing left in the well shall be cut off at the lake bottom or below.

32.2 Lessee shall plug any well in a manner that:

(a) ensures protection for potential oil and gas producing reservoirs;

(b) prevents the harmful infiltration of water into oil, gas, water, or salt formations;

(c) constitutes no hazard to users of the surface;

(d) retains all fluids in their source formations; and

(e) seals off reservoirs from those above and below.

32.3 Lessee shall also plug and abandon all wells on the leased premises in accordance with the requirements of the Pennsylvania Gas Operations, Well Drilling, Petroleum, and Coal Mining Act of 1955 administered by the Oil and Gas Division, Pennsylvania Department of Mines and Mineral Industries, and all other applicable laws of the Commonwealth. A copy of the plugging certificate approved by the Oil and Gas Division shall be supplied to Lessor. Failure to comply with the above plugging requirement will be reason for cancellation of this lease and the posted bond will be forfeited in order that Lessor may properly plug such wells.

34. PRODUCTION AND TRANSPORTATION

34.1 Construction of any permanent or semipermanent structures to be utilized for production, storage, processing, or transportation of any fluids produced from wells must be approved in writing by Lessor, the United States Coast Guard, and the United States Army Corps of Engineers. Detailed plans for any such structures must be submitted to Lessor at least twenty (20) days prior to commencement of construction. No construction shall begin until such plan is approved.

34.2 All platforms utilized for supporting pumping and other equipment shall be firmly anchored in the lake bottom. Such platforms shall be of fabricated steel design of rigid construction able to withstand all adverse weather conditions including moving ice. Such platforms may also be utilized for other operations incident to well operation such as paraffin solvent injection, temporary oil and waste storage, oil and gas processing equipment such as separators, gas heaters, and heater treaters. All such platforms shall be designed in such a manner that will confine any fluids which could escape into the lake thereby causing contamination or pollution in any degree. All platforms shall be approved and marked with suitable navigation markers as required by the United States Coast Guard and United States Army Corps of Engineers.

35. WELL RECORDS, LOGS, AND REPORTS

35.1 Lessee shall keep a daily drilling record which will describe the formations penetrated, depth and volumes of water, oil, gas, and liquid hydrocarbons found while drilling each well on the leased premises. Any other data that is usually acquired in the normal procedure of drilling shall be recorded and furnished to Lessor, such as drilling time, rate of fill-up, lost circulation zones, caving strata, casing records, core analyses, mud log analyses, perforation, and production test data. Within thirty (30) days after completion of each well, Lessee shall furnish Lessor an accurate location plat, a detailed lithologic log, and history of the well including geologic, drillers, electrical, and any other well surveys made to obtain subsurface information. In addition, any logs, records, and data pertaining to the completion or treatment of wells shall be made available within thirty (30) days after they are made. A drillers log shall be furnished to the Oil and Gas Division, Pennsylvania Department of Mines and Mineral Industries, in accordance with the requirements of the Pennsylvania Gas Operations, Well Drilling, Petroleum, and Coal

Mining Act of 1955. Upon request, samples of all formations penetrated and parts of cores taken, accurately labeled with the name of the well, and interval of depth shall be furnished to Lessor at Lessee's expense. Lessee shall also ship a complete sample suite to the Pennsylvania State Geological Survey, State Office Building, 300 Liberty Avenue, Pittsburgh, Pennsylvania 15222, within thirty (30) days after completion of each well.

36. AUDITS

36.1 Lessee shall furnish to Lessor, at its request, the meter charts covering the production of each well on the lease. Lessor may keep such charts for examination for a period not to exceed ninety (90) days. Lessee shall furnish or secure for Department promptly any statements furnished to Lessee by any person or corporation to whom Lessee delivers for sale or transport any oil, gas, and other products produced from the leased premises.

36.2 Lessee further authorizes and directs any person, association, company, partnership, corporation, or other entity to whom Lessee sells or furnishes gas, oil, and liquid hydrocarbons, produced from any well covered by this lease, to disclose and exhibit accounts and other instruments to representatives of Lessor at Lessor's request having to do with the transactions involving payments to Lessee, his heirs, administrators, executors, successors, and assigns for gas, oil, and liquid hydrocarbons from wells covered by this lease.

36.3 Lessee further grants to Lessor the right, at any time, to examine, audit, or inspect books, records, and accounts of Lessee pertinent to the purpose of verifying the accuracy of the reports and statements furnished to Lessor, and for checking the amount of payments lawfully due under the terms of this lease. Lessee agrees to provide every aid or facility to enable such audit to be made by Lessor. If such audit should disclose any gross error or fraud by Lessee in payment of royalties, then Lessee shall pay the cost and expense of said audit together with the deficiency. However, in case of fraud by Lessee, such payments shall not preclude Lessor in his discretion from cancelling this lease upon delivery to Lessee of written notice of Lessor's intention.

37. LESSEE'S TERMINATION

37.1 Lessee may at any time surrender this lease in its entirety or any number of tracts, measuring 1 Minute Latitude by 1 Minute Longitude, and comprising six hundred and thirty (630) acres more or less of the block or blocks leased; provided, however, that such surrender must be evidenced by written notice accompanied by a release or releases in recordable form delivered to Lessor thirty (30) days prior to the effective date thereof, and Lessee has performed all commitments with which Lessee is charged to the effective date of surrender. It is also agreed that any amount paid as an advance bonus, land rental, previous to the effective date of said surrender, shall be deemed liquidated damages due Lessor, and shall be in no way prorated or subject to claim by Lessee for return to Lessee. Under no circumstance and regardless of well spacing requirements, may portions of this lease be surrendered other than on the basis of the tracts described above. Lessee is not then in default of any obligations under this lease.

37.2 In the event that producing wells are to be retained, Lessee shall be entitled to retain that drainage acreage attributable to each well as previously provided under the section entitled "SUBSEQUENT WELLS." Lessee shall deliver to Lessor a release or releases in duly recordable form approved by Lessor. Lessee shall be relieved of all obligations thereafter accruing as to acreage surrendered and any rental thereafter coming due shall be reduced in the same proportion that the acreage covered hereby is reduced; provided, however, that Lessee shall not be relieved of any obligation which accrues prior to such surrender.

38. REMOVAL

38.1 Lessee shall have six (6) months after termination, abandonment, or surrender of this lease, or any part hereof, in which to remove all machinery, well structures, equipment, platforms, pipelines, and other materials and structures resulting from Lessee's operations.

39. RELEASE

39.1 Lessee shall not be granted a final release from the terms of this lease until an inspection of the leased premises by Lessor indicates the proper removal procedure has been completed.

40. ABANDONMENT AND STORAGE RIGHTS

40.1 In the event the development of this lease demonstrates, in the opinion of Lessor, that this tract has potential value as a gas storage reservoir (no storage rights are demised to Lessee under the terms of this lease), before any well shall be plugged, the well, equipment, property, and casing involved shall first be offered to Lessor, his nominee or assignee, at the then fair market value of those items. Such firm offer shall be made in writing to Lessor at least thirty (30) days prior to commencement of removal of the equipment from the well by Lessee.

41. LESSOR'S TERMINATION

41.1 If Lessee shall fail or refuse to pay any rental or royalty due under the terms of this lease within thirty (30) days after demand in writing by Lessor, or if Lessee shall violate, or fail to perform any of the covenants or provisions of this lease, Lessor shall have the right to terminate the lease.

41.2 In case of default in the payment of any sum of money due under the provisions of this lease within thirty (30) days after demand in writing by Lessor or the breach of any other of the terms of this lease, Lessee hereby authorizes and empowers the Attorney General of the Commonwealth of Pennsylvania, or any attorney of any court of record to appear for it in an amicable action of ejectment for the leased premises above described, to be entered by the Prothonotary in which said Lessor shall be plaintiff and said Lessee defendant and confess judgment therein in favor of the plaintiff and against the defendant for the said leased premises and authorize the immediate issuing of a writ of Habre Facias Possessionem (without asking leave of court) waiving all stay and exemption laws and release of errors.

42. INDEMNITY

42.1 Lessee shall, at all times, hereinafter indemnify and save harmless Lessor from and against all detriment, damage, loss, claims, demands, suits, and expenses, or other claims of any kind whatsoever, which the said Lessor may sustain, suffer, or be subject to directly or indirectly by reason of location, obstruction, presence, maintenance, renewal, or removal of said operations permitted by this agreement or resulting therefrom.

43. BOND

Lessee agrees to give Lessor a surety or performance bond with satisfactory corporate surety in the principal sum of Forty Thousand Dollars ($40,000.00) at the time this lease is executed. Lessee shall also give Lessor a surety bond with satisfactory corporate surety in the principal sum of Twenty Thousand Dollars ($20,000.00) prior to the commencement of each and every well drilled on the leased premises. Upon the satisfactory permanent abandonment of each and every well and the adequate restoration of the affected area of the lake, the bond deposited will be reduced by the principal sum of Twenty Thousand Dollars ($20,000.00). Each bond shall have a judgment clause in a form to be approved by the Attorney General conditioned on the faithful performance of the covenants of this lease. Said bonds shall be further conditioned that in the event Lessee shall fail to remove his equipment and machinery and properly abandon said well or wells, Commonwealth can execute upon said bonds to pay for the cost of removal of said equipment and machinery and proper abandonment of said well or wells. In addition, each bond shall be conditioned in favor of the Commonwealth for all damages that may arise as a result of fires, accidents, or any other causes brought about by Lessee or Lessee's agents occupying the leased premises.

44. INSURANCE

44.1 Lessee shall maintain in force an insurance policy of One Million Dollars ($1,000,000.00) which will cover accident and property damage liability resulting from each adverse occurrence or accident which may occur during any operation, including but not limited to exploration, drilling, producing, and delivering the well product conducted pursuant to this lease.

45. RELATED AGREEMENTS

45.1 Lessor will be furnished for record purposes and to protect his interests a copy of all agreements, contracts, letters, or memoranda entered into, made, or sent by Lessee in any way concerning the development, operation, or sale of products from this lease.

46. ASSIGNMENTS

46.1 Lessee shall not use or allow to be used, the leased premises for any other purpose than authorized by this instrument, and shall not assign or sublet, the leased premises in whole or in part at any time, or from time to time, without the prior written consent of Lessor. Lessee shall make application to obtain such consent in writing accompanied by a plat to Lessor describing the land to be assigned and the interest therein if less than the whole, together with the interest retained by assignor. Assignee shall agree in writing to be bound by all of the terms and provisions of the lease, and shall furnish a surety or performance bond satisfactory to Lessor. After Lessor has consented to the assignment, assignor shall be released from all liability under this lease arising or accruing subsequent to the date of such assignment as to the part or parts so assigned, and assignee, thereof, shall, thereupon, be deemed to have assumed and be responsible for the covenants, conditions, and obligations of this lease as to the part or parts assigned. In the event that a portion only of the leased premises is assigned, the default of any of the covenants, conditions, or obligations of this lease by one of the holders of a portion of the leased premises created by an assignment, will not affect the interests of a party not in default.

47. LIMITATION ON WARRANTY

47.1 The Commonwealth is considered to be the owner of the oil and gas rights under the leased premises, but makes no warranty as to the presence of oil and gas. In the event of an adverse claim to the premises affecting title to all or a portion of the oil and gas rights under the leased premises, notice of such claim will be given to Lessor who may with the approval of the Attorney General enter into an escrow arrangement for future rents and royalties accruing to such disputed portion under terms and conditions that he feels proper to safeguard the rights and interests of the Commonwealth. In the event an adverse claimant files suit against the Commonwealth or against Lessee, claiming title to all or a portion of the oil or gas rights under the leased premises, or if Lessee, after receiving notice of an adverse claim, institutes litigation in a court of competent jurisdiction to secure an adjudication of the validity of the claim, the rents and royalties accruing to the litigated portion shall be placed in an escrow account, until such time as the ownership of the disputed interest shall be determined by a court of competent jurisdiction. The rents and royalties placed in escrow shall be refunded to Lessee in an amount proportionate to the outstanding title if it is finally determined by compromise or by a court of competent jurisdiction that all or part of such rights are not owned by the Commonwealth.

48. FORCE MAJEURE

48.1 This lease shall not be terminated, in whole or in part, nor shall Lessee be held liable for damages, for failure to comply with express or implied covenants hereof if compliance, therewith, is prevented by or if such failure is the result of any Federal or State laws, executive orders, rules or regulations whether valid or invalid. If at the end of the primary term, hereof, such term has not been extended by production or drilling as in this lease provided and Lessee by reason of any of the above recited causes is unable to drill a well on the leased premises for oil or gas, the primary terms and the rental provision, hereof, shall be extended automatically from year to year for a period not to exceed ten (10) additional years unless further extension is approved by Lessor in writing so long as Lessee meets all requirements for payments of money and other obligations to Lessor; provided, however, upon the removal of such delaying cause, Lessee must commence operations within six (6) months after such removal. During any period that Lessee is unable to produce and/or market any products from the leased premises by reason of any of the above recited causes, this lease shall remain in force and effect.

IT IS HEREBY MUTUALLY UNDERSTOOD AND AGREED that this lease shall be legally binding on the parties hereto, their heirs, administrators, executors, successors, and assigns.

IN WITNESS WHEREOF, Lessor and Lessee have caused this lease to be duly executed and have caused their seals to be hereto affixed and attached by their proper officer, all hereunto duly authorized, on the date first above written.

ATTEST:

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

____

By______________________________
Secretary

ATTEST:

____

By______________________________(Seal)
Authorized Agent

APPROVED AS TO MANNER AND FORM OF EXECUTION:

APPROVED:

____
Assistant Attorney General

____
Governor

EXHIBIT C

M-O&G-LE-68
Oil & Natural Gas Lease
Stipulations

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

OIL AND NATURAL GAS LEASE FOR THE LANDS BENEATH LAKE ERIE ATTACHMENT

EXHIBIT "C"

Attached to and made a part of Oil and Natural Gas Lease For The Lands Beneath Lake Erie, No. , by and between: COMMONWEALTH OF PENNSYLVANIA and

STIPULATIONS FOR THE PROTECTION AND CONSERVATION OF THE SUBMERGED LANDS AND THE WATERS OF LAKE ERIE

1. PROTECTION AND CONSERVATION

1.1 It is hereby fully and mutually understood and agreed that no rights are granted in this lease which shall in any way be so construed as to impair the powers or duties of the Commonwealth or its representatives in the execution of the laws of the Commonwealth, having particular reference to the control, protection, maintenance, development and use of the submerged lands of Lake Erie and the waters covering these lands. Lessor shall have the right at any time to take any measures necessary for the control, protection, maintenance, development, and use of the submerged lands of Lake Erie and the waters covering these lands. This right includes but is not limited to the proper conservation and utilization of the oil and gas resources indigenous to these lands and the prevention of pollution and contamination of the waters of Lake Erie. Lessee shall not use or allow to be used the leased premises for any other purpose than that authorized by this lease. Lessee shall conduct all operations with deference to the purposes to which the leased premises are dedicated as set forth in the health, park, water, fish, and game laws, rules and regulations of the Commonwealth of Pennsylvania and in particular agrees to the following:

1.2 Lessee shall be familiar with and abide by all applicable laws, rules and regulations of the Water and Power Resources Board, and the Sanitary Water Board of the Commonwealth of Pennsylvania, the United States Army Corps of Engineers, and the United States Coast Guard. Any and all operations of Lessee must be approved by and carried out in accordance with all applicable laws, rules and regulations of the said agencies and Lessee shall promptly comply with any specific rulings by the said agencies concerning his operations.

1.3 Lessee shall be familiar with and comply with the objectives for Boundary Waters Quality Control established by the International Joint Commission and approved by the Governments of Canada and the United States.

1.4 Lessee shall possess a permit to drill issued by the Oil and Gas Division of the Pennsylvania Department of Mines and Mineral Industries. Lessee shall be familiar with and abide by all rules and regulations of said Oil and Gas Division. Lessee shall promptly comply with any orders or rulings of the Oil and Gas Division. Upon termination of this lease or upon the surrender of any block or tract, Lessee shall present to Lessor written verification from the Oil and Gas Division that Lessee has complied with all requirements of the law.

1.5 Lessee is responsible for all leasehold operations and shall make certain that his employees, agents, contractors and subcontractors, employees of contractors and subcontractors have been informed of and comply with the terms, requirements, provisions, and conditions contained in this lease and any laws, rules or regulations pertaining to pollution, contamination, public health, and safety in Lake Erie.

1.6 Employees of Lessee, his agents, contractors and subcontractors, employees of contractors and subcontractors shall be informed to comply with any oral or written order issued for corrective action by Lessor and other Commonwealth and Federal agencies having jurisdiction over Lake Erie or their authorized representatives.

1.7 Lessor shall stop any operation on the leased premises which is a source or potential source of pollution and contamination of Lake Erie waters. Immediate corrective action must be taken by Lessee. Operations shall not be allowed to resume until it has been demonstrated to the satisfaction of Lessor that any pollution or contamination of the lake waters will not occur.

1.8 Lessor or his authorized representatives shall have the right to inspect the leased premises at any time for the purpose of making any investigations or tests to ascertain whether the terms, requirements, provisions, and conditions contained in this lease are being complied with.

1.9 Failure of Lessee to comply with any of the terms, requirements, provisions, and conditions contained in this lease shall be reason for cancellation and Lessee's bond shall be forfeited to carry out any unfulfilled requirements or conditions.

2. HUNTING AND FISHING

2.1 Lessee, his employees, agents, contractors and subcontractors, employees of contractors and subcontractors shall not engage in hunting or fishing upon the leased premises, except as permitted by law, and shall endeavor to avoid injury to or destruction of wildlife and fish. Lessee shall not interfere with any fishing rights thereon, do damage to or interfere with the fishing nets or appliances used for fishing in the waters of Lake Erie.

3. POLLUTION CONTROL

3.1 Lessee shall not pollute or contaminate the waters of Lake Erie in any manner whatsoever, or damage the aquatic life of the lake or allow extraneous matter to enter and damage any mineral or water-bearing formation. All oil and gas operations shall be conducted in such a manner as to preclude the pollution and contamination of the waters of Lake Erie. In this lease, pollution and contamination shall mean the throwing, discharging, draining, spilling, running, flowing, or pumping of any deleterious solid or liquid organic or inorganic materials into the waters of Lake Erie or fresh water-bearing or mineral formations underlying the bottom of Lake Erie.

3.2 All solid or liquid, organic and inorganic materials which may be harmful or hazardous to life or property, or which result in an unsightly appearance, shall not be disposed of into the waters of Lake Erie. Lessee shall immediately notify Lessor and all responsible State and Federal agencies in the event any deleterious substance is introduced into the waters of Lake Erie, including, but not limited to, salt water, oil, liquid hydrocarbons, gas, other liquid and nonliquid waste materials, which is potentially dangerous or harmful to all humans, animal, aquatic life, wildlife, property, or the quality of the water of Lake Erie.

3.3 Lessee shall take immediate corrective action in all cases to prevent further pollution or damage to Lake Erie waters and shall take such corrective measures as are deemed necessary by Lessor, his authorized representatives, or any other State and Federal agencies having jurisdiction over Lake Erie.

3.4 Lessee shall pay for any and all damage or destruction to the property, including shoreline, life as set forth in paragraph 3.2, and the waters of Lake Erie resulting from operations under this lease. The cost of said damage or destruction shall be determined by Lessor, Pennsylvania Game Commission, or Pennsylvania Fish Commission.

3.5 Lessee shall promptly when ordered by the Sanitary Water Board of the Commonwealth of Pennsylvania comply with any specific rulings concerning his operations. Before beginning any well, Lessee shall submit plans to the Sanitary Water Board and to Lessor for approval; said plans showing and describing methods by which contamination and pollution will be prevented and waste disposed of without adverse affects upon the waters of Lake Erie. All cuttings and materials, liquid or nonliquid, organic or inorganic shall be contained in tanks or other storage facilities and shall be conducted to shore and disposed of onshore in areas approved for such disposal in accordance with the laws of the Commonwealth of Pennsylvania. Exceptions to the above prescribed disposal may be granted if it can be satisfactorily demonstrated to Lessor and other responsible State and Federal agencies that no pollution or contamination of the waters of Lake Erie will occur. If drilling operations are conducted by air, gas, or air foam, Lessee shall also provide sufficient means by which dust and/or foam dispersal are abated, kept to a minumum and shall not constitute a nuisance.

3.6 Lessee shall obtain the necessary water encroachment permit from the Water and Power Resources Board, Department of Forests and Waters before equipment is moved onto any well location.

3.7 No drilling shall be permitted within one mile of a public water supply or industrial water supply intake crib, intake tunnel, or pipeline, nor within 1,000 feet of any outfall structure, municipal or industrial, for the discharge to lake waters of sewage or industrial waste.

3.8 Drip pans, or their equivalents shall be placed under any equipment from which pollutants may spill into Lake Erie.

3.9 Unmanned facilities shall be inspected and maintained at frequent enough intervals to assure that pollution of Lake Erie does not take place. There shall be adequate sumps and drainage systems installed on any structure in Lake Erie which has a possible source of pollution such as separators, heater treaters, and drip pans.

4. NOTIFICATION OF FIRES, BREAKS, LEAKS, OR BLOWOUTS

4.1 Lessee shall report immediately the following incidents to Lessor by telegraph or telephone, following which at his earliest opportunity he shall make a written report:

(a) all fires which occur at oil or gas wells, and oil or gas pipelines owned, operated, or controlled by him on leased premises;

(b) any breaks or leaks in tanks or pipelines from which loss of gas or oil occurred;

(c) any blowout or fire at a well causing escape of gas or oil and wastage of the same on the leased premises;

(d) all lightning strikes of tanks or pipelines used in connection with this lease.

4.2 Each report shall show the location of the well, tank, or other equipment affected, or pipeline break, in such a manner that the exact location thereof may be readily established, and shall include the estimated quantity of oil or gas lost, destroyed, or permitted to escape.

5. NAVIGATION REQUIREMENTS

5.1 Lessee shall obtain approval of the United States Coast Guard and the United States Army Corps of Engineers before causing any structures or installations including drilling platforms and pipelines to be placed in or upon Lake Erie. The Coast Guard and Army Engineers may also impose other restrictions related to shipping lanes, anchorages, docks, and areas under their jurisdiction.

5.2 Producing wells shall be marked by a buoy of a type approved by the United States Coast Guard.

5.3 Lessee shall not in any way interfere with navigation or with the use of any docks or wharves now existing or which may be hereafter constructed. No well shall be drilled until the United States Coast Guard has determined and specified the proper distance the well is to be located from navigation markers.

6. CONSERVATION OF OIL AND GAS AND PREVENTION OF WASTE

6.1 Lessee shall use every possible precaution to prevent waste of oil or gas in drilling and production operations and in storing or piping oil or gas, and shall not use oil or gas wastefully or allow it to leak or escape from natural reservoirs, wells, tanks, containers, or pipes. Waste shall mean:

(a) physical waste as that term is generally understood in the oil and gas industry;

(b) the inefficient, excessive, or improper use of, or the unnecessary dissipation of reservoir energy;

(c) the locating, spacing, drilling, operating, equipping, or producing or any oil or gas well or wells in a manner which causes, or tends to cause, reduction in the quantity of oil or gas ultimately recoverable from a reservoir under prudent and proper operations, or which causes or tends to cause unnecessary or excessive surface loss or destruction of oil or gas;

(d) the inefficient storing of gas or oil;

(e) the excessive flaring of gas from an oil or condensate well which may be economically utilized. However, all gas vented to the atmosphere must be flared except that which is encountered during drilling or reworking of a well.

6.2 Lessee shall provide in operating condition oil-saving and discharge equipment and emergency oil storage in case oil is encountered in a well during drilling or deepening operations.

7. APPEARANCE

7.1 Lessee shall, at all times, maintain his operations in a neat and presentable manner, removing all rubbish and debris as it accumulates.

8. GEOPHYSICAL SURVEYS

8.1 Lessee may conduct geophysical surveys on the leased premises after obtaining a permit for this purpose from Lessor. Geophysical operations shall be conducted only after said permit has been granted and under the terms and conditions set forth therein. Geophysical surveys shall be conducted using an energy source other than explosives which shall not injure fish life.

9. SAFETY REQUIREMENTS

9.1 A power boat in good working condition and approved by the United States Coast Guard must be available to persons on location at all times.

9.2 No machine, tool, or other equipment shall be used if it is unsafe, or not so constructed or operated to be reasonably safe for persons on or around drilling or operating wells.

9.3 Safety equipment including a first aid kit, hard hats, goggles, approved fire extinguishers, and

United States Coast Guard approved life preservers, shall be available to all persons on location at all times.

9.4 No open fires, stoves, or smoking will be permitted within seventy-five (75) feet of: the well during drill stem or other production testing; any equipment used for the separation, measurement, or storage of gas or oil; or of any well where oil or gas may be exposed to the atmosphere.

10. AIR SAFETY

10.1 Lessee shall be familiar with and conduct all operations in accordance with all applicable air safety laws, rules and regulations of the Pennsylvania Aeronautics Commission and the Federal Aviation Agency.

11. MINING AREAS

11.1 Lessee shall not commence any oil or gas operations which may affect the safety or adversely interfere with lake bed or underground mining operations. Lessee shall give notice in writing to Lessor and the persons engaged in said mining operations thirty (30) days prior to the commencement of any oil and gas operations in mining areas.

M-O&G-LE-68
Oil & Natural Gas Lease
Stipulations

GOVERNMENT AGENCIES WITH REGULATIONS PERTAINING TO OIL AND GAS EXPLORATION AND RELATED ACTIVITIES IN THE PENNSYLVANIA PORTION OF LAKE ERIE

The following State and Federal agencies shall be contacted for detailed information of the rules and regulations that govern the exploration for oil and gas in Pennsylvania's portion of Lake Erie and their approval must be obtained prior to conducting any operations in the lake.

Government agency and Address	Brief Statement of Agencies Jurisdiction
State	
Division of Minerals Department of Forests and Waters Harrisburg, Pennsylvania 17120	Leasing programs, terms, policies, and geophysical regulations.
Secretary Water and Power Resources Board Department of Forests and Waters Harrisburg, Pennsylvania 17120	Water encroachment regulations.
Secretary Sanitary Water Board Department of Health Harrisburg, Pennsylvania 17120	Disposal of water polluting materials and industrial wastes.
Executive Director Pennsylvania Fish Commission Harrisburg, Pennsylvania 17120	Regulations for the protection of fish life.
Executive Director Pennsylvania Game Commission Harrisburg, Pennsylvania 17120	Regulations for the protection of wildlife.
Deputy Secretary Oil and Gas Division Department of Mines and Mineral Industries State Office Building Pittsburg, Pennsylvania 15222	Oil and gas regulations and enforcement.

M-O&G-LE-68
Oil & Natural Gas Lease
Stipulations

Federal

District Engineer, Buffalo District Corps of Engineers Foot of Bridge Street Buffalo, New York 14207	Obstructions to the navigable capacity of waters of the United States as described in "Permits for Work in Navigable Waters."
Commander Ninth Coast Guard District 1240 East 9th Street Cleveland, Ohio 44199	Dangers to navigation as described in "Aids to Navigation Regulations."

DIVISION OF OIL AND GAS
NEW YORK STATE CONSERVATION DEPARTMENT

PROPOSED RULES AND REGULATIONS APPLICABLE TO OIL AND GAS OPERATIONS IN NEW YORK LANDS SUBMERGED UNDER LAKE ERIE

APRIL 14, 1969

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DIVISION OF OIL AND GAS
NEW YORK STATE CONSERVATION DEPARTMENT

PROPOSED RULES AND REGULATIONS APPLICABLE TO OIL AND GAS OPERATIONS IN NEW YORK LANDS SUBMERGED UNDER LAKE ERIE

CONTENTS

PART PAGE

565 PROMULGATION AND ENFORCEMENT OF RULES AND REGULATIONS

Section 565.1 Policy 133
Section 565.2 Definitions 134

566 REPORTS AND BONDS

Section 566.1 Organizational Reports 138
Section 566.2 Production and Purchase Reports 138
Section 566.3 Bonds 139

567 PERMITS TO DRILL, DEEPEN, PLUG BACK, CONVERT OR RECONDITION WELLS

Section 567.1 Application 140
Section 567.2 Issuance of Permit 141
Section 567.3 Permit In Mining Areas 141

568 WELL SPACING, UNITIZATION AND DRILLING RESTRICTIONS

Section 568.1 Well Spacing 143
Section 568.2 Well Spacing Orders 144
Section 568.3 Unitization 145
Section 568.4 Drilling Restrictions 145

569 DRILLING, EQUIPMENT OPERATING AND COMPLETION PRACTICES

Section 569.1 Commencement of Operations 146
Section 569.2 Identification of Wells and Facilities 147
Section 569.3 Blow-Out Preventers and Casingheads 147
Section 569.4 Drilling Mud 148
Section 569.5 Casing Program 148
Section 569.6 Deviation 149
Section 569.7 Completion of Wells 151
Section 569.8 Multiple Completions 152
Section 569.9 Completion Reports, Well Logs and Samples 153

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PART **PAGE**

570 PRODUCTION PRACTICES

Section 570.1 Gas Wells 154
Section 570.2 Oil Wells 155
Section 570.3 Pollution Control 156
Section 570.4 Salt Water Disposal 156
Section 570.5 Tanks and Facilities 157

571 PLUGGING AND ABANDONMENT

Section 571.1 Temporary Abandonment 157
Section 571.2 Permanent Abandonment 158
Section 571.3 Plugging Method 159

DIVISION OF OIL AND GAS
NEW YORK STATE CONSERVATION DEPARTMENT

PROPOSED RULES AND REGULATIONS APPLICABLE TO OIL AND GAS OPERATIONS IN NEW YORK LANDS SUBMERGED UNDER LAKE ERIE

PART 565

ADOPTION OF RULES AND REGULATIONS AND DEFINITIONS

(Statutory authority: Conservation Law §§ 70, 71)

Sec.
565.1 Policy
565.2 Definitions

Section 565.1 Policy

The Conservation Department, having been entrusted with the responsibility for administering and regulating activities relative to the natural resources of oil and gas within the State, does hereby adopt the following rules and regulations for lands submerged beneath Lake Erie, which have been formulated after consultation with State and Federal agencies, producers and other interested persons involved and after a public hearing relative thereto. The rules have as their objectives:

(a) the fostering, encouragement and promotion of the development, production and utilization of the natural resources of oil and gas in such a manner as will prevent waste;

(b) the operation and development of oil and gas properties in such a manner that a greater ultimate recovery of oil and gas may be had;

(c) the prevention of pollution and promotion of safety in all operations;

(d) full protection of the correlative rights and interests of all persons and the general public.

Section 565.2 Definitions

As used herein:

(a) *Block* shall mean an area whose sides measure five minutes of longitude and five minutes of latitude as designated on department maps.

(b) *Blow-out* shall mean an uncontrolled, sudden or violent escape of fluid from a drilling well.

(c) *Completion date* shall mean that date when a well is first capable of producing oil or gas into tanks or pipelines regardless of whether or not tanks or pipelines are installed or, in the case of a dry hole, the date on which plugging is completed.

(d) *Condensate* shall mean liquid hydrocarbons that were originally in gaseous phase in the reservoir and liquids recovered by surface separation from natural gas.

(e) *Converting* shall mean any operation whereby the status of a well is changed, for example from producing to input or visa versa.

(f) *Department* shall mean the Conservation Department.

(g) *Director* shall mean the director of the Division of Oil and Gas of the Conservation Department.

(h) *Field* shall mean the general area underlaid by one or more pools.

(i) *Gas* shall mean all natural gas, manufactured, mixed and by-product gas, and all other hydrocarbons not herein defined as oil or condensate.

(j) *Gas-oil ratio* shall mean the ratio of the volume of gas produced in standard cubic feet to each barrel of oil produced concurrently during any stated period.

(k) *Input well* shall mean any well that is drilled, deepened, plugged back or converted in any pool, underground stratum or horizon, for the purpose of injecting, disposing or storing fluids or gaseous substances.

(l) *Lease unit* shall mean a partial block, full block, or combination thereof which because of provisions set forth in an oil and gas lease; a drilling, pooling or other agreement; a rule, regulation, order or amendment thereof adopted by a governmental authority, or otherwise is treated as a single entity for the purpose of the development or operation thereof for hydrocarbons in Lake Erie.

(m) *Multiple completion* shall mean a mechanical arrangement which will result in the segregated injection and/or production into or from two or more pools or zones through a single well bore.

(n) *Offset operator* shall mean the operator of a lease unit or lands touching, adjacent or contiguous to a lease unit or lands.

(o) *Oil* shall mean crude petroleum oil and all other hydrocarbons, regardless of gravity, that are produced at the wellhead in liquid form by ordinary production methods and that are not the result of condensation of gas.

(p) *Operator* shall mean any person who causes a well to be drilled or operated.

(q) *Owner* shall mean any person who has the right to drill into and produce from a pool and to appropriate the oil or gas he produces therefrom either for himself or others or for himself and others.

(r) *Person* shall mean and include any natural person, corporation, association, partnership, receiver, trustee, executor, administrator, guardian, fiduciary, or other representative of any kind, and includes any department, agency, or instrumentality of the State or any governmental subdivision thereof.

(s) *Plugging and abandoning* shall mean the permanent sealing of a well bore and restoration of the wellsite in compliance with departmental rules and regulations.

(t) *Pollution* shall mean the throwing, discharging, draining, running, flowing, or pumping of any deleterious material into the waters of Lake Erie or fresh water sands underlying the bottom of Lake Erie.

(u) *Pool* shall mean an accumulation of oil, or gas, or both, which is located within the interconnected porous spaces in a rock formation beneath the surface of the earth; thus each zone of a structure which is completely separated from any other zone in the same structure is a pool.

(v) *Potential* shall mean the actual or computed volume of oil or gas that a well can produce in a day as determined by a test made in conformity with methods acceptable to the department.

(w) *Producer* shall mean the owner of a well or wells capable of producing fluids.

(x) *Producing well* shall mean any well capable of the production of fluids.

(y) *Purchaser* shall mean any person who directly or indirectly buys or takes production for his account.

(z) *Salt water* shall mean any water containing more than 250 parts per million of sodium chloride or 1,000 parts per million of total dissolved solids.

(aa) *Surface casing* shall mean casing extending through the fresh water zone and cemented at a sufficient depth below the top of a competent rock formation so that no leakage will occur.

(ab) *Temporary abandonment* shall mean the temporary discontinuance of operations on or the closing in of a well not capable of commercial production.

(ac) *Tract* shall mean an area within a block whose sides measure one minute of longitude and one minute of latitude as designated on department maps.

(ad) *Unit* shall mean two or more lease units or tracts which have been combined.

(ae) *Waste* shall mean:

(1) Physical waste, as that term is generally understood in the oil and gas industry;

(2) The inefficient, excessive, or improper use of, or the unnecessary dissipation of reservoir energy;

(3) The locating, spacing, drilling, equipping, operating, or producing of any oil or gas well or wells in a manner which causes, or tends to cause, reduction in the quantity of oil or gas ultimately recoverable from a pool under prudent and proper operations, or which causes or tends to cause unnecessary or excessive loss or destruction of oil or gas;

(4) The inefficient storing of oil or gas;

(5) The flaring of gas produced from an oil or condensate well after the department has found that the utilization thereof, on terms that are just and reasonable, is or will be within a reasonable time, economically feasible.

(af) *Well log* shall mean any wireline survey made of a well bore.

PART 566

REPORTS AND BONDS

(Statutory authority: Conservation Law §§ 70, 75, 76)

Sec.
566.1 Organizational Reports
566.2 Production and Purchase Reports
566.3 Bonds

Section 566.1 Organizational Reports

(a) Every person acting as a principal or agent for another or independently engaged in the exploration or drilling for, and production, transportation, purchasing, processing and storage of hydrocarbons and their products as derived from lands beneath Lake Erie shall file organizational information with the department on form OG1. Such filing shall not be necessary, however, if a filing of form OG1 relevant to operations elsewhere in the State of New York shall already have been made with the department.

(b) The provisions of subdivision (a) above also shall apply to every person acting as a principal or agent for another or independently engaged in the practice of well abandonment and salvage of subsurface equipment and/or of routine well servicing on a contract basis and who has not already filed a form OG1 with the department.

(c) Immediately after any change occurs as to the facts stated in the most recent report filed with the department on form OG1, an amended copy of said form showing the new organizational status shall be filed with the department.

Section 566.2 Production and Purchase Reports

(a) The producer or operator of each and every lease unit in Lake Erie containing one or more producing wells shall file with the department monthly a statement showing the amount of hydrocarbons and water produced from each lease unit and segregated by pool. The monthly statement shall be submitted to the office of the department no later than forty-five (45) days after the end of the month for which the information is being reported.

(b) All purchasers, transporters or takers of hydrocarbons from producing wells in Lake Erie shall file with the department such periodic reports, at least annually, as the purchaser, transporter or taker may compile which will reflect the amount of hydrocarbons purchased, transported or taken. For this purpose forms OG3 and/or OG4 or any substitutes acceptable to the department may be utilized.

Section 566.3 Bonds

(a) So that funds will be available to cover well plugging and abandoning costs in the event that an owner or operator has failed to carry out these obligations in compliance with the rules, regulations, orders and amendments thereof of the department, thereby making it necessary that the department carry out these operations, there shall be required from the owner or operator of all wells, except as hereinafter provided, a bond.

(b) Each of the bonds referred to hereinafter shall be issued by a corporate surety authorized to do business in the State of New York. Each bond shall be in favor of the New York State Conservation Department utilizing the form provided by the department. It shall remain in force and effect until the plugging and abandoning of the applicable well or wells is complete and approved by the department, or the bond is released by the department.

(c) The bonding requirements for wells are as follows:

(1) For each well, a bond in the amount of $20,000 shall be required.

(2) A bond in the amount of $200,000 may be accepted at the discretion of the department for ten (10) or more wells.

(d) In lieu of the bonds of subdivision (c) above, negotiable securities or cash in equivalent amounts may be deposited with and for use by the State of New York.

(e) Every person acting as principal or agent for another or independently engaged in the business of pulling casing and plugging wells and salvage of equipment on a contract basis or who acquires a well or wells for that exclusive purpose, shall be required to provide a bond in the amount of $200,000.

PART 567

PERMITS TO DRILL, DEEPEN, PLUG BACK, CONVERT OR RECONDITION WELLS

(Statutory authority: Conservation Law §§ 70, 73, 75)

Sec.
567.1 Application
567.2 Issuance of Permit
567.3 Permit in Mining Areas

Section 567.1 Application

No owner or operator shall commence operations to drill, deepen, plug back, convert or recondition a well for exploration, production or input until he has filed an application with the department utilizing the form provided by the department and has received a permit as specified in section 567.2 below.

Section 567.2 Issuance of Permit

(a) Upon determination that the application is in order and that all other requirements have been satisfied, the department shall issue a permit to the applying owner or operator.

(b) If the operations for which the permit is granted have not commenced and been pursued in a diligent and workmanlike manner within one (1) year from the date of issuance of the permit, said permit shall expire.

(c) If, prior to the commencement of operations, a well spacing order is applied for or is pending, the department may suspend the permit. After a decision relative to well spacing, the suspended permit either shall be cancelled by the department or shall be reinstated with the time while in suspension not charged against the one (1) year permit period.

(d) Under unusual or emergency circumstances the department may permit the commencement of operations by verbal authority prior to the issuance of a formal permit, or rescind previously-issued permits.

Section 567.3 Permit in Mining Areas

(a) Persons engaged in underground mining operations or having underground mining rights beneath or adjacent to Lake Erie are entitled to receive notice of the commencement of any phase of oil or gas well operations which may affect the safety of such underground mining operations or of the mining properties involved if they have advised the department of the existence and location of such underground mining properties and mining rights. The advisal shall be in the form of a plat showing the location of the properties and rights together with a listing of the names and addresses of all owners, lessees and operators thereof.

(b) Upon receipt of an application for permit to drill, deepen, plug back, convert or recondition a well which is located within one thousand (1,000) feet of any known underground mining property or mining rights, the department shall advise the applying well owner or operator of the names of all owners, lessees or operators of any such known mining properties if such persons are known and have so registered with the department, and shall identify the mining properties involved. The department then shall suspend processing of the application for permit until receipt from the applying well owner or operator of a résumé of the planned operations insofar as they pertain to the protection of any known or anticipated mining operations.

(c) Upon receipt of the résumé of the planned operations discussed in subdivision (b) above, the department shall advise all owners, lessees or operators thereof who have listed with the department as provided in subdivision (a) above of the receipt of the application for permit for a well located within one thousand (1,000) feet of the known underground mining property or mining rights. Accompanying this advisal shall be the résumé of the planned operations insofar as they pertain to the protection of any known or anticipated mining operations. If no objections by the owners, lessees or operators of the underground mining properties or rights to the well location or operations are made known in writing to the department within ten (10) days from mailing of notice, and the application is otherwise in order, the permit shall be granted.

(d) The notification to the owners, lessees or operators of the underground mining properties or rights and compulsory ten (10) day waiting period discussed in subdivision (c) above shall not be required if the résumé of planned operations is accompanied by written consent to the planned location and operations insofar as they pertain to the protection of any known or anticipated mining operations by all owners, lessees, or operators of the underground mining properties or rights.

(e) In the event that objection to the location or planned operations insofar as they pertain to the protection of any known or anticipated mining operations is made by the owners, lessees or operators of the underground mining properties or rights within ten (10) days from the mailing of notice, the department shall promptly schedule a public hearing.

PART 568

WELL SPACING, UNITIZATION AND DRILLING RESTRICTIONS

(Statutory authority: Conservation Law §§ 70, 77, 78, 89)

Sec.

568.1 Well Spacing
568.2 Well Spacing Orders
568.3 Unitization
568.4 Drilling Restrictions

Section 568.1 Well Spacing

(a) In the absence of an order of the department establishing well spacing, all wells for the production of hydrocarbons from lands beneath Lake Erie shall be subject to a maximum density of one well per full tract, which contains approximately 626 acres. Exceptions to this well spacing restriction may be allowed by the department.

(b) No well shall be drilled closer than one thousand (1,000) feet to any boundary of a tract unless an exception has been granted by the department.

Section 568.2 Well Spacing Orders

(a) To promote effective development, use, or conservation of the natural hydrocarbon resources, an order establishing well spacing may be promulgated by the department for any pools developed beneath Lake Erie.

(b) Prior to promulgation of any well spacing order involving the interests of more than one well owner or operator or any royalty owner other than the State of New York, a public hearing on the matter shall be conducted by the department acting either on its own motion or upon receipt of an application therefor from any interested party.

(c) Any application for a well spacing order shall be made in writing and shall include any information the applying party deems relevant to the following factors which the department will consider in deciding upon a spacing order:

(1) the area underlaid by the pool;

(2) the plan of well spacing currently being employed and that proposed for the pool;

(3) the depth at which production from said pool has been found;

(4) the nature and character of the stratum within which the pool is located and the fluids contained therein;

(5) an estimate of the maximum area which may be drained efficiently and economically by one well;

(6) any other available information pertaining to said pool which may be of probative value to the department in determining the proper well spacing therefor, with due and relative allowance for protection of correlative rights and prevention of waste.

(d) The application shall be accompanied by a neat, legible plat drawn to scale which shows the area for which well spacing is proposed. The plat should include well locations and relevant boundaries.

(e) After promulgation, any spacing order for a pool will supersede for that pool the well spacing provisions of section 568.1 above.

(f) Where, in its opinion, there exists good and sufficient reason to permit an exception to the provisions of any spacing order, the department may grant same. Any application for such exception shall be made in writing as a separate attachment to the application for permit as outlined in section 567.1 and shall set forth in ample detail the reason or reasons for such exception request. If a location exception is granted, the department may adjust the production from such well or take such other action as it may deem necessary for the protection of correlative rights or to prevent waste.

Section 568.3 Unitization

To secure the most efficient and economical development and production and to effect maximum conservation of resources, a lessee may participate in a joint development or unitization of a pool, or any portion thereof. This shall not be done without full disclosure of the joint operating agreement and plan and approval thereof by the department.

Section 568.4 Drilling Restrictions

No well shall be located nearer than one-half (1/2) mile from shore, one-half (1/2) mile from a public water intake crib, or one thousand (1,000) feet from any other structure or installation in Lake Erie including municipal or industrial outflows for the discharge to lake waters of sewage or industrial wastes without permission from the department. No drilling shall be allowed within one-half (1/2) mile of either the New York-Pennsylvania or New York-Canada boundaries without permission from the department. Well locations shall also be subject to the restrictions of the U.S. Coast Guard, Corps of Engineers and any other State and Federal agencies having jurisdiction thereover.

PART 569

DRILLING, EQUIPMENT OPERATING AND COMPLETION PRACTICES

(Statutory authority: Conservation Law §§ 70, 73, 75)

Sec.
569.1 Commencement of Operations
569.2 Identification of Wells and Facilities
569.3 Blow-out Preventers and Casingheads
569.4 Drilling Mud
569.5 Casing Program
569.6 Deviation
569.7 Completion of Wells
569.8 Multiple Completions
569.9 Completion Reports, Well Logs and Samples

Section 569.1 Commencement of Operations

(a) Before any well operation is conducted, the owner or operator thereof shall make such preparations and precautions as are necessary to prevent waste and pollution of Lake Erie by oil or gas well fluids.

(b) The regional headquarters of the Division of Oil and Gas having supervision of oil and gas activities relative to Lake Erie shall be notified in writing or by telegram at or prior to the start of actual operations.

Section 569.2 Identification of Wells and Facilities

(a) The owner or operator shall display a prominent sign on all structures placed in Lake Erie for operations conducted under permit from the department. This sign which shall be lettered in a manner and style approved by the department, shall be located in a conspicuous place and shall include the name of the owner or operator and the name of the well or facility, designating block, tract and number.

(b) Identification acceptable to the department shall be placed at the well head of all completed wells.

Section 569.3 Blow-Out Preventers and Casingheads

(a) The casinghead and control equipment on all wells shall at all times be in such condition as to effectively control any fluids encountered.

(b) All wells being drilled, deepened or serviced by a rig and not equipped with a complete casinghead and control equipment shall be equipped with blow-out control equipment that will completely close off both the open hole and around any equipment being employed in the well. Said equipment shall be operable at a reasonable distance from the wellhead. It shall be equipped with a bleed off valve of the proper size and working pressure and such flow lines as are necessary to carry fluids away from the wellhead.

(c) When a rotary drilling rig is in use it shall be fitted with a kelly cock in proper working order for the purpose of shutting off the hose connection should the hose blow out.

(d) All wells shall be equipped with casingheads or connections of sufficient rated working pressure and with adequate piping and valves that will permit the pumping of fluid between any two strings of casing.

Section 569.4 Drilling Mud

The drilling mud used in wells drilled with rotary tools shall at all times be of sufficient density to control formation pressures and prevent blow-outs or flows of water. The tanks and piping containing the mud system shall be designed and maintained so as to prevent any leakage into Lake Erie.

Section 569.5 Casing Program

(a) The casing utilized in all wells shall be such as will prevent the escape of oil, gas or water out of one stratum into another or the intrusion of water into an oil or gas stratum. It also shall be such as will prevent pollution of fresh water.

(b) On all wells a string of surface casing shall be set below the top of competent rock formation and below the deepest fresh water zone. It then shall be cemented with sufficient cement to completely fill the annular space behind the surface casing. After the cement has been permitted to set in accordance with prudent current industry practices, the surface casing shall be tested by pump pressure to at least one thousand (1,000) pounds per square inch. If, at the end of thirty (30) minutes, a decrease in pressure greater than ten (10) percent is evident, the casing shall be deemed improperly set and/or cemented. For drilling to continue, the casing shall be repaired and/or recemented until a satisfactory pressure test is obtained.

(c) In the event that cable tools are employed, any fluids encountered above the ultimate objective in such quantities as to constitute a hazard or waste shall be cased off before drilling proceeds. The casing shall be tested by bailing to insure shut-off before drilling is resumed.

(d) In the event a well is to be completed for production, production casing extending from the pay zone to the surface shall be required. The production casing shall be cemented to a height sufficient to prevent any movement of fluids in the annular space. After the cement has been permitted to set in accordance with prudent current industry practices, the production casing shall be tested by pump pressure to at least one thousand (1,000) pounds per square inch. If, at the end of thirty (30) minutes, a decrease in pressure greater than ten (10) percent is evident, the casing shall be deemed improperly set and/or cemented. For the well to be placed on production, the casing shall be repaired and/or cemented until a satisfactory pressure test is obtained.

Section 569.6 Deviation

(a) The point at which a well first penetrates a producing formation shall not vary unreasonably from the vertical drawn from the center of the hole at the surface. Minor deviations will be permitted, however, without special permission for short distances, to straighten the hole, to sidetrack junk, or to correct other mechanical difficulties.

(b) If for any reason the department feels that a well has been deviated excessively, it shall have the right to require the owner or operator to have a complete angular deviation and directional survey made in the well by an approved well surveying company and certified as to correctness at the owner or operator's sole cost, risk and expense. In the event the survey reveals any unreasonable violations of the applicable well location or spacing regulations, the department may either require the excessively deviated well to be redrilled or to be plugged and abandoned at the option of the owner or operator.

(c) Any owner or operator so desiring, also may petition the department for permission to have an angular deviation and directional survey made in any wells on lease units offsetting the lease units of the interested owner or operator. If, after public hearing on the petition, the department feels the request is justified, and the petitioner has deposited an appropriate security or bond, the department shall issue an order authorizing the survey to be made by an approved well surveying company and certified as to correctness at the sole cost, risk and expense of the petitioner. In the event the survey reveals an unreasonable violation of the applicable well location or spacing requirements, the department then shall assess all the costs of the survey to the violator and may either require any excessively deviated well to be redrilled or to be plugged and abandoned at the option of its owner or operator.

(d) Controlled directional drilling also shall be permitted upon the approval of the department. Any owner or operator desiring to intentionally deviate a well from the vertical shall first make written application to the department. The application shall contain the following information:

(1) target bottomhole location in feet from the two nearest tract boundaries;

(2) reason for the proposed intentional deviation;

(3) names and addresses of the operators of all offsetting tracts and a statement that each has been sent a copy of the application by registered mail, and the date of such mailing.

(e) Concurrently with the filing with the department of the application to intentionally deviate the well, the applicant shall send a copy of said application by registered mail to the operators of all offsetting tracts.

(f) Upon receipt of the application to intentionally deviate the well, the department will hold same for ten (10) days. If within said ten (10) day period any offset operator reciting reasonable cause, shall file in writing with the department a protest to such intentional deviation, or if the department is not in accord with the proposed deviation, the application shall be scheduled for public hearing. If no objection from either an offset operator or the department is interposed within the ten (10) day period, and all other things being in order, the application shall be approved and written permission for the intentional deviation shall be issued by the department. The compulsory ten (10) day waiting period shall not be required if the application for permission to intentionally deviate the well is accompanied by the written consent of the operators of all tracts off-setting the tract containing the well proposed for deviation and the department is in accord.

(g) Within thirty (30) days after the completion of an intentionally-deviated well, a complete angular deviation and directional survey of the well made by an approved well surveying company and certified as to correctness shall be filed with the department.

Section 569.7 Completion of Wells

(a) It shall be unlawful to complete a well in such manner as will permit the escape of oil, gas or water out of one stratum into another or the intrusion of water into an oil or gas stratum.

(b) All wells shall be cleaned, tested and produced in a manner which will prevent pollution. Procedures and equipment shall be used that will eliminate fire hazards.

(c) All wellheads are to be of minimum practical height, with the base thereof situated at or below the level of the lake bed and with a minumum water depth above the wellhead of fifteen (15) feet.

(d) All wellheads shall be equipped with a device designed to deflect trawler nets and protect the wellhead and approved by the department.

(e) A control device approved by the department shall be installed below the level of the lake bottom in all producing wells to prevent accidental flow of fluids therefrom.

(f) No platform for production, processing, or any other operations shall be erected unless specifically authorized by the department and other State and Federal agencies having jurisdiction.

Section 569.8 Multiple Completions

(a) It shall be unlawful to commingle the production from two or more pools prior to the metering or measurement thereof unless specific permission for such commingling has been granted by the department.

(b) For any well in which a multiple completion has been effected, the completion report shall contain relevant supplemental information.

(c) Upon request by the department, any well in which a multiple completion has been effected shall be tested at any reasonable time to demonstrate the effectiveness of the separation of the pools, such testing to be witnessed by representatives of the department and any offset operators so desiring.

Section 569.9 Completion Reports, Well Logs and Samples

(a) Within thirty (30) days after the completion of any operation conducted under permit, a completion report utilizing the form provided by the department and summarizing thereon the relevant details shall be filed by the owner or operator with the department.

(b) In the event a multiple completion has been effected in a well, the completion report shall be accompanied by a diagrammatic sketch of the multiple completion installation and a written résumé of the procedures and equipment employed in effecting the completion and testing to insure separation of the pools.

(c) For newly-drilled or deepened wells, the completion report shall be accompanied by a well log and such other information as the department may specifically require. The measurement datum for the well log and all other measurements in connection with the well shall be clearly specified. The well log also shall show the elevation in feet of the measurement datum with respect to mean sea level.

(d) For newly-drilled or deepened wells, the owner or operator also may be required to provide up to two sets of bagged and labeled drill cutting samples upon request of the department. If these are to be required, the operator will be so advised at the time the permit for the operation is issued. The samples are to be washed unless the well is drilled with rotary tools using air or gas as the drilling fluid.

(e) If so requested by the owner or operator, any information relative to the well, including the completion report, the well log and the drill cutting samples, shall be only for the confidential use of the department, the Geological Survey of the Museum and Science Service of the New York

State Department of Education and other departments of the State Government until one (1) year after the date on which total depth is reached in newly-drilled or deepened wells and one year after the date of commencement of operations on any other activities conducted under permit. However the location, depth, elevation, casing and cementing data, and status of all wells shall be available to the public at all times.

(f) The owner or operator of the well in which the discovery completion in a new pool is effected shall have the opportunity to nominate in order of decreasing preference three proposed pool and field names to designate the newly-discovered oil or gas accumulation. The department then will assign a pool and field name, taking care to avoid conflict with any names already in use and included in the department's glossary of names.

PART 570

PRODUCTION PRACTICES

(Statutory authority: Conservation Law §§ 70, 73, 75)

Sec.
570.1 Gas Wells
570.2 Oil Wells
570.3 Pollution Control
570.4 Salt Water Disposal
570.5 Tanks and Facilities

Section 570.1 Gas Wells

(a) All gas wells capable of production shall be equipped with wellhead controls adequate to properly contain and control the flow of fluids therefrom.

(b) No gas from any gas well, except such as is produced in a clean up period not to exceed forty-eight (48) hours after any completion or stimulation operation, plus that used for the controlled testing of the well's potential in a period not to exceed twenty-four (24) hours, plus that used for any operational requirements, shall be permitted to escape into the air. Extensions of these time periods shall be granted on an administrative basis by the department upon application therefor by the owner or operator and the demonstration of sufficient good cause.

(c) The department may require the periodic testing of any gas well in such manner as the department may prescribe in order to establish the producing capacity and characteristics of the well. The owner or operator of any offsetting tract shall be permitted to have a representative present to witness any such test.

(d) All gas, when produced or sold, shall be measured with an adequate and suitable meter of sufficient capacity or measured in such other manner as may be approved by the department. The meter charts and relevant records shall be kept in a permanent file for a period of at least three (3) years and be made available to the department upon written request therefor.

Section 570.2 Oil Wells

(a) All oil wells capable of production shall be equipped with wellhead controls adequate to properly contain and control the flow of fluids therefrom.

(b) The department, acting on its own motion or that of any interested party and after a relevant public hearing, shall have the right to establish limiting gas-oil and water-oil ratios and related operating practices.

Section 570.3 Pollution Control

(a) All Lake Erie operations shall be conducted with extreme care and diligence to prevent any pollution of lake water including compliance with the water quality standards adopted by the Water Resources Commission of the State of New York.

(b) All pollutants produced in conjunction with oil and gas operations in Lake Erie shall be contained in tanks or other closed facilities and be transported to shore and disposed of in accordance with all relevant laws except as hereinafter provided.

Section 570.4 Salt Water Disposal

Salt water may be disposed of by injection into the strata from which produced or other proved salt water-bearing strata after application for such injection has been approved by the department and under such conditions as may be prescribed. Concurrently with the filing with the department of the application to dispose of salt water by injection, the applicant shall send a copy of said application by registered mail to all offset operators of the lease unit on which the input well will be located. Said application shall be accompanied by a list of the names and addresses of the offsetting operators and a statement that each has been sent a copy of the application by registered mail, and the date of such mailing. Upon receipt of the application to dispose of salt water by injection, the department shall hold same for ten (10) days. If within the said ten (10) day period, any offset operator reciting reasonable cause, shall file in writing with the department a protest to such disposal, or if the department is not in accord with the proposed injection, the application shall be scheduled for public hearing. If no objection from either an offset operator or the department is interposed within the ten (10) day period and all other things being in order, the application shall be approved and written permission for the injection shall be issued by the department prescribing therein any special conditions that must prevail. The compulsory ten (10) day waiting period shall not be required if the application for permission to dispose of salt water by injection is accompanied by the written consent of the offsetting operators and the department is in accord.

Section 570.5 Tanks and Facilities

Approval for the location of tanks and other facilities involved with the production of oil and gas from beneath Lake Erie shall be obtained from the department prior to installation thereof.

PART 571

PLUGGING AND ABANDONMENT

(Statutory authority: Conservation Law §§ 70, 73, 75)

Sec.
571.1 Temporary Abandonment
571.2 Permanent Abandonment
571.3 Plugging Method

Section 571.1 Temporary Abandonment

(a) It shall be unlawful for the owner or operator of any well to temporarily abandon same for more than 90 days without specific permission from the department for an extension of the time period during which temporary abandonment is permitted.

(b) Permission for an extension of the time period during which temporary abandonment is permitted shall be granted by the department upon written application therefor by the owner or operator and the demonstration of sufficient cause.

(c) Upon termination of the period of lawful temporary abandonment, the owner or operator shall either resume operations or permanently plug and abandon the well as hereinafter provided.

Section 571.2 Permanent Abandonment

(a) It shall be unlawful for the owner or operator of any well to permanently plug and abandon same until he has given notice at least ten (10) days in advance of the commencement of plugging operations to the department utilizing the form provided for that purpose by the department, same to be accompanied by a detailed outline of the planned plugging procedure, and has received a permit from the department therefor.

(b) Upon approval of the planned abandonment, the department shall send the permit therefor to the owner or operator responsible for the plugging operations and arrange for a representative from the department to be present at the well to witness the plugging operations. The permit shall contain a confirmation of the well location and date and time of the commencement of the plugging operation as specified by the owner or operator on the notice of intention.

(c) In the event the well to be plugged and abandoned is one upon which operations have been in progress on a continuous basis as previously authorized by the department, the notice of intention to abandon and the detailed plan may be given verbally or by telegram to the Division of Oil and Gas regional headquarters having supervision of oil and gas activities relative to Lake Erie. In such event, the regional headquarters shall acknowledge receipt of the notice of intention to abandon either verbally or by telegram. Although this procedure shall be allowed to prevent excessive waiting time, the owner or operator still shall provide the department as promptly as possible, the formal notice of intention to abandon outlined in subdivision (b) above.

Section 571.3 Plugging Method

(a) The well shall be completely filled with cement pumped through tubing or drill pipe. Such filling of the well shall be from the bottom of the hole upward.

(b) Any casing or equipment extending above the lake bed shall be removed.

(c) Within thirty (30) days after the plugging of any well, a plugging report utilizing the appropriate form provided by the department, shall be filed with the department by the owner or operator responsible for the plugging operation.

STATE OF MICHIGAN

NATURAL RESOURCES COMMISSION
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September 11, 1969

PUBLIC HEALTH ENGINEERING
SEP 15 1969
National Health & Welfare

Mr. Peter M. Higgins, P. Eng.
Chairman, Ad Hoc Committee
Public Health Engineering Division
Department of National Health and Welfare
Environmental Health Centre
Tunney's Pasture
Ottawa 3, Ontario
CANADA

Dear Mr. Higgins:

I have reviewed the draft of the report entitled, "Potential Oil Pollution Incidents from Oil and Gas Well Activities in Lake Erie", transmitted with your letter of August 26, 1969.

The report has been substantially improved from the earlier draft and further incorporates the comments forwarded with our letter of August 11, 1969.

Although the report may, in its present form, represent the majority opinion of the International Lake Erie Water Pollution Board as an individual member of the Board I request that Michigan's position with respect to drilling operations be transmitted, along with the Board's report, to the International Joint Commission. This position has been set forth in a number of documents, but I will refer specifically to two recent actions.

The Michigan Water Resources Commission, at its meeting on June 23, 24 and 25, 1969, adopted the following motion:

> "The Commission endorsed the policy adopted by the then Conservation Commission in January 1960, to the effect that no leases shall be granted for state-owned bottom lands, except as may become necessary to counteract trans-boundary drainage of Michigan oil or gas or to meet national emergency, and, further, that the Commission endorse the position set forth in the 1967 Memorandum of Understanding between representatives of the State of Michigan and the Province of Ontario, which has been approved by the International Joint Commission to the effect that permits for oil or gas well drilling in the boundary waters of Lake Huron, the St. Clair River, Lake St. Clair and the Detroit River shall not be issued, and that notice of any change in that policy proposed by either party shall be given to the other party at least 30 days prior to such change."

MICHIGAN
THE GREAT LAKE STATE

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In addition to this, the following resolution was signed by Governor Milliken at the recent Governors' Conference:

"Whereas, the Great Lakes constitute the largest natural body of water on the North American Continent; and

Whereas, because of the Great Lakes industry, commerce, agriculture and recreation are greatly enriched; and

Whereas, efforts are being made to even further advance trade and recreation and thereby creating more jobs; and

Whereas, advances are constantly and rapidly being made in controlling pollution; and

Whereas, thought is now being given to drill for oil and gas in the Great Lakes; and

Whereas, technical knowledge to date does not provide enough safeguards from possible damage inflicted on the lakes and therefor to the economic conditions of the surrounding area;

Now Therefore Be It Resolved, that the following Governors of the Great Lakes states (Ohio, Michigan, Indiana, Illinois, Wisconsin, and Minnesota) request that the United States Department of Interior prohibit any drilling for gas and oil in the Great Lakes.

Be It Further Resolved, that the Governors of the Great Lakes states request Prime Minister Trudeau of Canada and the appropriate agency of the government of Canada to prohibit the drilling for gas and oil in the area of the Great Lakes under their jurisdiction."

Very truly yours,

WATER RESOURCES COMMISSION

Ralph W Purdy

Ralph W. Purdy
Executive Secretary

RWP:ms

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